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Master Project Facilities Plan, Expansion of Reno-Sparks Joint Water Pollution Control Plant Cities of Reno and Sparks, Nevada Appendices A-D

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Appendix A - Regional Economy, Future Population Growth and Housing
Appendix B - Air Quality
Appendix C - Water Law and Water Rights
Appendix D - Cultural Resources Survey for the Master Project

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Draft Environmental Impact Statement

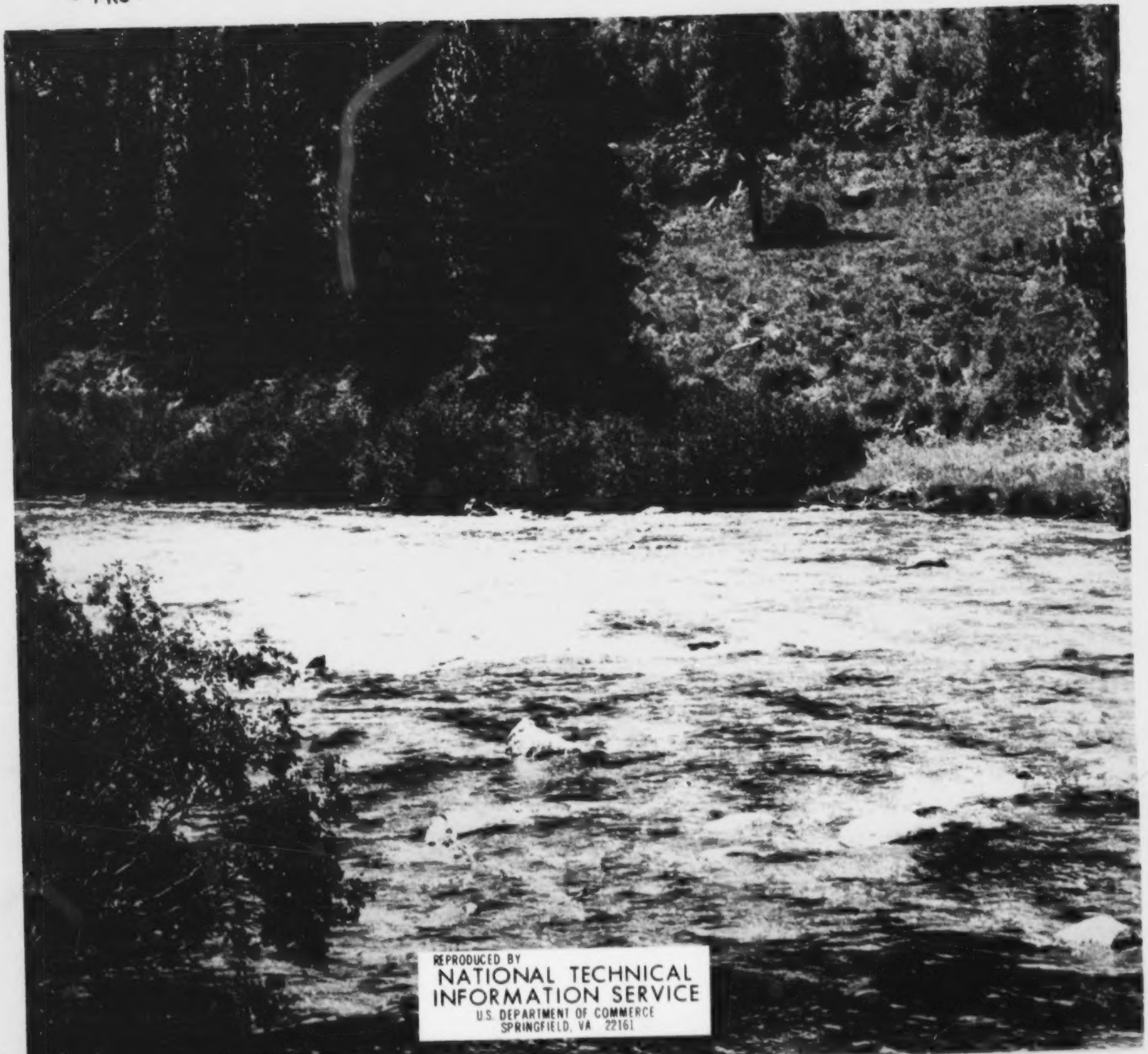
APPENDICES A-D

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

MASTER PROJECT FACILITIES PLAN

Expansion of Reno-Sparks Joint Water Pollution Control Plant

Cities of Reno and Sparks, Nevada



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APPENDICES A-D

This volume contains Appendices A-D to the Draft Environmental Impact Statement (DEIS) on the Master Project Facilities Plan, Expansion of Reno-Sparks Joint Water Pollution Control Plant. There are 11 appendices to the EIS, covering the topics listed below. The appendices are bound in three volumes, containing Appendices A-D, E-G, and H-J, respectively. The DEIS, as well as the other two appendix volumes, are available from:

Mr. Thomas Severino, Project Officer
U. S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, CA 94105

Appendix A - Regional Economy, Future Population Growth and Housing

This appendix discusses the following topics: the Reno economy; Reno's economic future; future population growth, including population projection and forecasting techniques, and forecasts of employment growth in the State of Nevada; and housing Reno's future growth.

Appendix B - Air Quality

This appendix includes the following information: meteorology data of the Truckee Meadows area; air quality monitoring data of the Truckee Meadows; and emissions forecast for the Truckee Meadows.

Appendix C - Water Law and Water Rights

This appendix discusses the following topics: institutional constraints affecting Truckee River water rights, including discussion and case briefs of major judicial and agency actions and institutional constraints affecting the Master Project, including the Endangered Species Act, state and federal water law principles, California-Nevada interstate water compact, court decrees, administrative actions and current litigation.

→

Appendix D - Cultural Resources Survey for the Master Project

This appendix discusses the historic and prehistoric background of the study area, discusses the results of a 10 percent cultural resources survey of lands potentially disturbed by Master Project alternatives and identifies potential mitigation measures for adverse impacts.

Appendix E - Surface Water Hydrology

This appendix discusses the following topics relating to surface water hydrology: climate; Truckee River flow characteristics; historical flows; diversion; consumptive uses; and M&I use.

Appendix F - Surface Water Quality

This appendix discusses the following topics relating to surface water quality: water quality standards; historical water quality; various water quality studies conducted by private and governmental agencies; existing water quality; and major pollutional inputs to the Truckee River.

Appendix G - Hydrologic Modeling

This appendix discusses the hydrologic modeling that was undertaken to identify Truckee River flow and quality changes that could result from Master Project alternatives. The appendix presents the assumptions and conclusions of the modeling; the land use assumptions developed to predict declines in agricultural land use resulting from projected urban growth; urban water use assumptions; and material supplementing the results published in the EIS.

Appendix H - Limnology of Pyramid Lake and Lahontan Reservoir

Topics discussed in this appendix include physical, chemical and biological characteristics and major ecological concerns regarding Pyramid Lake and Lahontan Reservoir.

Appendix I - Endangered and Threatened Species

This appendix discusses the life history, habitat requirements, reasons for decline, physical and biological factors necessary to restore natural populations and present efforts to restore the endangered cui-ui and threatened Lahontan cutthroat trout.

Appendix J - Fish and Wildlife Resources

This appendix discusses the life histories of fishes found in the Truckee River from Verdi to Pyramid Lake and identifies wildlife species found in the study area.

Appendix K - Background Agreements and Permits

Background agreements, permits and administrative actions pertinent to the Reno-Sparks JWPCP Master Project are included in this appendix.

APPENDIX A

THE REGIONAL ECONOMY, FUTURE POPULATION GROWTH AND HOUSING

July 1979

An appendix to the Preliminary
Draft Environmental Impact Statement
on the Reno/Sparks Joint Water Pollution
Control Plant Facilities Plan

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Chapter 1

THE RENO ECONOMY

Introduction

Nevada is a sparsely-populated state. In an area of 111,000 square miles, it has 633,000 residents (1977 estimate). The two major urban areas, Las Vegas and Reno-Sparks, account for 80% of the population, leaving 117,100 people in the rest of the state.

Why is the state so sparsely populated, and why have the urban areas developed at all? A brief look at the usual reasons why regions grow provides some insight into Nevada's unusual situation.

People are usually drawn to live in given regions by the employment opportunities there. Businesses and industries, which provide those employment opportunities, are drawn to those regions by the unique resources which offer advantages to the businesses' or industries' activities. For example, agricultural production attracts food processing plants, local raw materials attract production which uses these materials, harbors or rivers which provide transportation opportunities attract trading enterprises or firms which find it profitable to produce goods near shipping terminals.

Nevada has historically had none of these resources. The only major waterway nearby - the Colorado River - touches the state only along part of its border with Arizona, and is not navigable. Silver deposits discovered in the late nineteenth and early twentieth centuries were exhausted soon after they were found, and did not bring lasting industry into the region. Major transportation routes, crossing Nevada (but not each other) on their ways to California's ports, offered through transport no reason to turn off for cargo reorganization, intermediate product assembly or other activities. The Nevada desert landscape supported no intensive agricultural production sufficient to attract farm- or food-related industries.

How, then, did Reno and Las Vegas grow into urban centers? Perhaps the key is found in Nevada's creation of its own unique resource: the legalization of gaming activities in the state. When Nevada legalized gaming, it created a condition that existed nowhere else in the United States until 1978; because the industry flourished in areas where its customers could "comparison shop" and enjoy other tourist-related activities, the existing population centers - Reno and Las Vegas - attracted most of the new gaming activity. With the improvement of transportation opportunities - especially the airplane - which enabled non-business travelers to cover great distances in short times and a general improvement in gaming's public imagine (engineered in large part by some of the Nevada casino operators), the gaming resource became the foundation on which the larger economy was built. The nature of this foundation and the economy built on it in the Reno-Sparks area is the subject of this chapter.

The Visitor-Gaming-Tourist Industry

Brief History

The visitor-gaming-tourist industry in Nevada has its beginnings in the informal gambling that was a pasttime for miners during the early days of the state. Gambling was first restricted in 1861, with the creation of the Nevada Territory, but was legal again before 1870. It was outlawed again in 1909 but legalized again, with some restrictions, in 1915.

In 1931, hoping to raise public funds during the depression and to institute some control over the widespread illegal gaming activity in the state, Nevada adopted a "wide open gambling" law that legalized all forms of casino gambling. The law was administered and enforced at the county level. According to the Commission on the Review of the National Policy Toward Gambling, "it was in Reno that gambling first acquired the aura of genuine respectability"; the Commission attributes that phenomenon to the opening of Harold's Club in 1937.* That club differed from others in its bright lights and colorful decor as well as its lowered stakes, designed to attract small bettors. Harold's also was the first to provide free transportation home for players who went broke.

Harrah's, opened in 1946, extended the industry's search for players. According to the Commission, Harrah's conducted a market study which revealed that elderly and low income people might become gamblers in the proper setting; based on this conclusion, the club instituted bus service to and from 31 cities.

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*Gambling in America (Washington, D.C.: 1976).

These types of enterprises set the stage for the gaming industry's expansion into the visitor-tourist realm. Casinos today are generally associated with major hotels; also found on the premises are entertainment areas and perhaps some shops or other recreational opportunities. Reno's proximity to Lake Tahoe and other nearby ski areas, coupled with visitors' tendencies to associate the two places with each other, reinforces the recreational character of the visitor market.

Role in the Economy

Economically speaking, the gaming industry is integrally associated with tourists and other visitors, so that it may appropriately be termed the visitor-gaming-tourist industry. This industry is a part of the larger "services" sector of the economy.

The Services Sector. The services sector is comprised of private and quasi-public (but not government) activities whose primary product is work performed rather than tangible goods. Subsectors are:

- Hotels and other lodging places, including recreational camps;
- Personal services, including laundries, cleaners, photographers, beauty and barber shops, shoe repairs and funeral homes;
- Business services, ranging from advertising and data processing to janitorial services;
- Automotive repair, services and garages;
- Miscellaneous repair services;
- Motion pictures, from production to theaters;
- Amusement and recreation services (except motion pictures;
- Health services;
- Legal services;
- Educational services;
- Social services;
- Museums, art galleries, botanical gardens and zoos;
- Membership organizations, including business associations, professional organizations, labor unions, political groups, religious groups and civic and fraternal groups;
- Private household services; and
- Miscellaneous services, such as engineering, architecture, accounting and bookkeeping.*

---

*From the Standard Industrial Classification Handbook published by the California Employment Development Department.

This services sector constitutes a major portion of the Reno economy. It accounted for 39,200 (38%) of the 104,300 jobs in the Reno Standard Metropolitan Statistical Area in 1978. Compared to 1970 data, these figures indicate that the services sector grew by 19,600 jobs during the eight year period and represented 3.0% more of the total number of jobs than it had at the beginning of the decade (Table A-1). The percentage increase indicates that the sector gained in relative importance in the overall economy during the period.

Table A-1

GROWTH IN SERVICES SECTOR
EMPLOYMENT IN THE RENO SMSA, 1970-78

Year	Number of Jobs	Increase	Percent of Total Jobs*	% Increase
1970	19,600	19,600	34.6	3.0
1978	39,200		37.6	

*Total jobs in 1970 = 56,600; 1978 = 104,300. Includes only non-agricultural wage and salary employment.

Source: State of Nevada, Employment Security Department, annual Reno SMSA employment summary

Growth in the services sector may also be measured by the amount of income and the proportion of total local income it generates. In 1976 (the most recent date for which figures are available), services accounted for $295,047,000 (31.1%) of the total $947,745,000 non-farm personal income in the Reno SMSA. This figure represented an increase of $128,850,000 but a decrease of 2.5% in the proportion of overall non-farm personal income generated by the sector compared to 1971 (Table A-2). This decrease indicates that the average wage/salary per employee in the services sector did not rise as fast as it did in other sectors during the 1970-76 period. The slower rise could have been caused either by (1) smaller increases across the entire income range or (2) the addition of a large proportion of lower-paying jobs, which would have counter-balanced the increases in higher wage brackets.

Table A-2

CHANGES IN EMPLOYMENT AND PERSONAL INCOME*
ASSOCIATED WITH THE SERVICES SECTOR,
RENO SMSA, 1970-76

Year	% Total Jobs	Personal Income from Services	Total Personal Income	% of Total Personal Income
1970	33.4	$166,197,000	$494,425,500	33.6
1976	33.3	295,047,000	947,745,000	31.1

*Non-farm personal income only. All data refer to non-farm wage and salary employment.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Personal Income by Major Sources, 1969-1976 (Table 5.00), Washoe County, Nevada

Growth in the Visitor-Gaming-Tourist Industry. While there is no one category of the Standard Industrial Classification (SIC) code system that encompasses the visitor-gaming-tourist industry, employment in that industry may be estimated by using the data for "hotels, gaming and recreation" published by the State of Nevada.* These data indicate that the industry constituted the primary component of growth in services during the 1970-78 period, accounting for 14,200 (72%) of the 19,600 jobs added in the eight years. This dramatic increase, associated with the opening of MGM Grand Hotel (which employs 3,500 to 3,900 people, depending on the season) in March 1978 and other major recent casino/hotel expansions, also increased the importance of the visitor-gaming-tourist industry in the overall economy: in 1970, it accounted for 64.8% of service jobs and 22.4% of all jobs in the SMSA; in 1978, it accounted for 68.6% of service jobs and 25.8% of all jobs in the area (Table A-3).

---

*The state does not publish income-by-industry data.

Table A-3

CHANGE IN VISITOR-TOURIST-GAMING EMPLOYMENT, THE RENO SMSA, 1970-1978

Year	Number of Jobs	% of All Service Jobs	% of All Jobs*
1970	12,700	64.8	22.4
1978	26,900	68.6	25.8

*Non-farm wage and salary jobs.

Source: State of Nevada, Employment Security Department, annual Reno SMSA employment summary

Effects of the Visitor-Gaming-Tourist Industry on Other Economic Activities. The visitor-gaming-tourist industry, as part of a larger economic system, affects the health and growth of other economic activities. In general, growth in one sector encourages growth in other sectors. For example, growth in the visitor-gaming-tourist industry may bring - and has brought, in Reno - new tourists to the city. While there, these tourists not only gamble and sleep; they also eat, shop, use transportation services and probably automobile service stations (and perhaps auto repairs); they may require financial services. The demands for these activities generated by the tourists lead to new jobs in those sectors; for example, new restaurants and stores may be built or additional staff may be hired at existing establishments. Both the visitor-tourist-gaming and other new jobholders need housing, food, clothing, furnishings, entertainment and other goods and services; consequently, the economic sectors which provide those goods and services will also grow as they respond to those added demands.*

The Visitor-Gaming-Tourist Industry and Services Sector as Basic Industries

Because they are industries which rely primarily on Nevada's unique resource (legal gaming) for their location there and because they influence the health of other economic activities, the visitor-gaming-tourist industry and its parent services sector comprise part of the economic base of the Reno SMSA. Economically speaking, a basic industry - an industry which constitutes part of the area's economic base - is one which draws in dollars from outside the local area; in other words, it gains net income for its local area. Therefore, a basic industry must meet the needs of its local area residents and, in addition, meet the needs of some non-local residents. Basic industries may therefore also be thought of as export industries even though sometimes (and certainly in the case of Reno's visitor-gaming-tourist industry) all sales in that industry take place within the local area.

---

*The amount of growth depends on whether employees are new in the area or have simply switched jobs; if job-switchers are replaced on their old jobs, though, the net effect is the same as if they were new.

It is rare, however, that an industry is either 100% basic or 100% non-basic (that is, it serves no-one from outside the local area). For example, at least some of the activity of the visitor-gaming-tourist industry is attributable to Washoe County residents who occasionally gamble, dine out or take in a show at a casino. The amount of employment or income associated with local residents' demands is the non-basic component of the industry, while the remainder - that amount associated with non-locals' demands - is the basic component.

The categorization of industries as basic and non-basic is important for economic forecasting because it offers an indication of how much additional growth may result from growth in those industries. For example, new employees hired to meet demand in the visitor-gaming-tourist industry generate demand for homes, food, clothing and other goods and services, but the relationship is not one new job in each other industry for every new job in gaming. Instead, each new gaming-related job may generate enough demand for one new job in all other sectors; put another way, 100 new gaming jobs may generate 50 other new jobs. The 50 other new jobs may, in turn, generate enough demand to support 25 additional jobs, and so on until the demand increment is too small to add even one more job to the economy. This pattern is called the multiplier effect. In general, basic jobs have higher multipliers than non-basic jobs because they bring money into the local area from outside and circulate it once to generate the first "other" new jobs, which are non-basic. Also, non-basic jobs are more closely related to the size of the local population than are the basic jobs because most of their customers are local residents. Thus, assignment of an industry to the basic and non-basic categories gives a general idea of how many additional jobs will result from growth in that industry.

Categorizing Industries as Basic and Non-basic. Although the visitor-gaming-tourist industry is easily classified as a basic industry for the Reno SMSA, it is not as easy to categorize other industries as either primarily basic or primarily non-basic. To do so requires some analysis of the sources of demand for each industry's output.

One way to estimate the sources of demand is to derive the location quotient for each industry. The fundamental assumption underlying the analysis of location quotients is that if every area produced the types and amounts of outputs to exactly satisfy only the local demand for those outputs, then every area would have the same proportion of its employment (or income) associated with each economic sector. (This assumption implicitly suggests, in turn, that demand patterns are essentially the same in all regions.) To the extent that proportions deviate from the national average, then, the respective regions either oversupply or undersupply local demand. The amount of oversupply satisfies non-local demand and comprises the basic element of the particular industry. The amount of undersupply is compensated by imports from other areas.

The location quotient for each industry in an area may be calculated using either employment or income data. (Any differences between the quotients calculated would result from the variation in industry-by-industry wage rates among regions.) The location quotient (LQ) for the Reno SMSA in any given industry (x) may be calculated for employment using the following formula:

$$LQ = \frac{\text{Reno Employment in Industry}^{x}}{\text{Total Reno Employment}} \div \frac{\text{National Employment in Industry}^{x}}{\text{Total National Employment}}$$

If the calculated location quotient is greater than 1.0, then the size of the basic component may be estimated as follows:

$$\text{Basic Component} = \frac{\text{Location Quotient} - 1.0}{\text{Location Quotient}}$$

These calculations confirm that the visitor-gaming-tourist industry in Reno is a basic industry and suggest that the basic component comprises nearly 93% of the industry's employment, as shown in Table A-4.

Table A-4

CALCULATING THE LOCATION QUOTIENT AND BASIC COMPONENT OF THE RENO SMSA VISITOR-TOURIST-GAMING INDUSTRY, 1978[1]

	Reno SMSA	U.S.	Reno SMSA Location Quotient
Industry Employment	28,900[2]	1,685,100[3]	
Total Employment	107,300	86,688,000	
Industry Share of Total Employment	26.9%	1.9%	13.881

$$\text{Basic Component} = \frac{13.881 - 1.0}{13.881} = 92.8\%$$

[1] Reno SMSA data for October 1978; U.S. data for September 1978.

[2] Includes "Hotels, Gaming and Recreation" as tabulated by Nevada Employment Security Department.

[3] Includes "Hotels, motels and tourist courts" and "Amusement and recreation services" (SIC No. 701 and 79).

Sources: Nevada Employment Security Department, Economic Update, October 1978, Reno, "Establishment Based Industrial Employment"; Bureau of Labor Statistics (by telephone), Employment and Earnings, September 1978, "Employment on nonagricultural payrolls by industry covered by unemployment insurance", establishment data (Table B-2).

Basic and Non-basic Industries in the Reno Economy

While the visitor-gaming-tourist industry provides a dramatic example of a basic economic activity, the Reno economy also includes other sectors that are basic and thus help the region to "make a living" by bringing new dollars into the area. Location quotients for broadly-defined industry categories, presented in Table A-5, indicate that services (the "parent" sector for visitor-gaming-tourist), construction, transportation and public utilities, retail trade and perhaps finance-insurance-real estate and wholesale trade are the basic industries in Reno. The uncertainty about whether to include the latter two industries stems from the different location quotients derived from employment and income statistics; in both cases, the industry's regional share of employment is higher than the national average but its regional share of personal income is lower than the national average.

Table A-5

LOCATION QUOTIENTS FOR RENO SMSA INDUSTRIES, 1971-76

Industry	Location Quotient		% of Output Exported	
Industry	Employment	Income	Employment	Income
Agricultural Services and Related	.6864	.8987	*	*
Mining	.5232	.4178	*	*
Construction	1.3585	1.6889	26.4	40.8
Manufacturing	.3056	.2835	*	*
Transportation and Public Utilities	1.2955	1.3311	22.8	24.9
Wholesale Trade	1.0016	.9369	0.2	*
Retail Trade	1.0696	1.1927	6.5	16.2
Finance, Insurance, Real Estate	1.0762	.9838	7.1	*
Services	1.8680	1.8901	46.5	47.1
Government	.8311	.9471	*	*

*Assumed to be a net importer of this product or service.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Employment by Type and Broad Industrial Sources, Summary Analytics, 1971-76 (Table 25.01) and Personal Income by Major Sources, Summary Analytics, 1971-76 (Table 5.01), Washoe County, Nevada.

The remainder of this section describes the various basic and non-basic sectors of the Reno SMSA economy. It should be noted that employment estimates are based on the number of jobs in the SMSA, regardless of whether they are full-time or part-time jobs. The term "all jobs," when used in this chapter, refers to non-agricultural wage and salary employment unless otherwise indicated.

Basic Industries

Services. The services sector includes the visitor-gaming-tourist industry in addition to all those activities listed on page 3. The number of service jobs in the Reno SMSA grew from 19,600 in 1970 to 39,200 in 1978 and 40,600 in January 1979. The 1970-78 increase represented an average annual growth rate of 9.1%. The hotel-gaming-recreation subsector accounted for about 69% of service employment in 1978.

Earnings in the service sector have not kept pace with employment growth. Data are available for the 1970-76 period; they indicate that while the number of service jobs increased by 34.7%, the total personal income derived from the services sector, adjusted for inflation, increased by only 21.1%. Put another way, the real wage per employee in 1976 dollars declined from $11,333 in 1970 to $10,188 in 1976, as shown in Table A-6. By 1976, services ranked eighth out of the nine major sectors of the Reno economy in average earnings, with an estimated annual wage of $10,188.

Table A-6

AVERAGE EARNINGS IN SERVICE JOBS, 1970-76

Year	Total Personal Income	Number of Employees	Personal Income per Employee	CPI*	Adjusted Personal Income per Employee (1976 Dollars)
1970	$166,197,000	21,496	$ 7,731	116.3	$11,333
1976	295,047,000	28,961	10,188	170.5	10,188

*Consumer Price Index, U.S. Annual Average.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Employment by Type and Broad Industrial Sources, 1969-76 (Table 25.00) and Personal Income by Major Sources, 1969-76 (Table 5.00), Washoe County, Nevada.

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The service sector's contribution to the Reno area economy may be measured in several ways in addition to the amount of personal income derived from employment in it. Gross taxable gaming revenues reached $251.8 million in 1977, up from $116.1 million in 1970 and $211.6 million in 1976. Gross room receipts from hotels and motels amounted to approximately $62 million in 1977, up from about $43.6 million in 1975. Expressed in constant (1976) dollars, gross taxable gaming revenues grew from $170.2 million in 1970 to $211.6 million in 1976 and $236.5 million in 1977; gross room receipts grew from $46.1 million in 1975 to $58.2 million in 1977.

Contract Construction. Jobs in contract construction increased from 3,500 (6.2% of all jobs) in 1970 to 8,700 (8.3%) in 1978, an overall increase of 149% and an average annual increase of 12.1%. This increase was not achieved via steady growth, however; after net gains in 1970 through 1973, the number of jobs decreased in 1974 and again in 1975, turning upward again in 1976. The average annual growth rate during the 1975-78 period was 31.8%. The recent increase in construction jobs may be linked to the erection of new hotel/casinos, warehousing and related structures and homes for new area employees/residents.

Unlike the services sector, earnings in the construction industry kept pace with both employment growth and inflation, as shown in Table A-7. By 1976, the average annual contract construction wage was $19,580, making construction workers the highest paid average wage earners in the area.

The contribution of the construction industry to the economy may be measured by the value of authorized building permits. Table A-8 shows that after dropping nearly 86% between 1973 and 1974, the valuation rose 286% between 1974 and 1977 in the SMSA. The overall increase in valuation during the 1972-77 period was 148%, approximately 3.3 times the inflation rate (44%, derived from the consumer price index) during that time.

Transportation and Public Utilities. Because of its proximity to west coast markets and Nevada's favorable tax laws - including the liberal Free Port Law, which allows storage and intermediate processing of goods without inventory or value-added taxed - the Reno metropolitan area has evolved as a center for warehousing, distribution and related light manufacturing. Under these conditions, transportation has become an important basic industry in the area.

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Table A-7

CHANGES IN CONSTRUCTION WAGES, 1970-76, RENO SMSA

Year	Total Personal Income	Number of Employees	Personal Income per Employee	CPI*	Adjusted Personal Income per Employee (1976 Dollars)
1970	$46,294,000	3,658	$12,656	116.3	$18,554
1976	92,067,000	4,702	19,580	170.5	19,580

*Consumer Price Index, U.S. Annual Average.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Employment by Type and Broad Industrial Sources, 1969-76 (Table 25.00) and Personal Income by Major Sources, 1969-76 (Table 5.00), Washoe County, Nevada.

Table A-8

VALUATION OF BUILDING PERMITS AUTHORIZED, RENO SMSA
($1,000)

Year	City of Reno	City of Sparks	Remainder of Washoe County	Total
1972	59,258	35,862	28,955	124,075
1973	78,955	33,551	36,203	148,709
1974	38,350	20,789	20,739	79,878
1975	57,229	21,110	30,942	109,281
1976	125,179	44,031	36,172	205,383
1977	195,552	32,847	79,645	308,045

Source: Prospectus for Washoe County Airport Authority, Nevada Airport System Improvement Revenue Bonds, Appendix III, p. 23

Employment in transportation and public utilities grew from 4,700 to 6,800 between 1970 and 1978, an overall increase of 45% at an average annual rate of 4.7%. It did not, however, grow as fast as the total number of jobs, and declined from 8.3% of the jobs in 1970 to 6.5% in 1978.

As with the construction industry, average earnings in this sector have kept up with both employment and inflation. The average wage per employee in 1970 was $10,078; the average in 1976 was $16,676. When adjusted for inflation to 1970 dollars, the 1976 wage was $11,375, nearly 13% higher than the 1970 level. In 1976, this sector ranked second in per employee personal income in the Reno SMSA.

Retail Trade. The retail trade sector employed 9,400 people in the Reno SMSA in 1970, and grew steadily to 16,200 in 1978. The 72% increase during the seven year period represented an average annual growth rate of 7.0%.

Growth in the retail sector is associated with both greater numbers of visitors to the Reno area and greater numbers of permanent residents of both Washoe County and the surrounding area. The 1972 Census of Retail Trade identified three major retail centers in the Reno metropolitan area: the Reno central business district, with 12.4% of 1972 retail sales volume; the three centers at South Virginia Street and Plumb Lane (Park Lane Centre, Shopper's Square and Lakeside Plaza) with 14.5%; and K-Mart Plaza on Oddie Boulevard in Sparks with 2.7%. Since then, two more major retailing centers have been developed: Crossroads Plaza and Old Town Mall near the Centennial Coliseum and Mervyn's/Gemco-Reno center on South Virginia and Moana. A portion of the 1.4 million square foot Meadowood Mall has also opened. Between 1972 and 1977, retail sales in the Reno area more than doubled, as shown in Table A-9.

Table A-9

TOTAL TAXABLE SALES, RENO SMSA, 1972-77

Year	Gross Sales	Change From Previous Year
1972	$ 585,395,000	(14%)
1973	683,651,000	17%
1974	727,449,541	6%
1975	813,692,611	12%
1976	944,952,202	16%
1977	1,177,961,370	25%

Source: Prospectus for Washoe County Airport Authority, Nevada Airport System Improvement Revenue Bonds, Appendix III, p. 6

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Earnings in retail trade were lower than in any other sector of the Reno economy in 1976, averaging $8,734 per job. In real terms - that is, adjusted for inflation - that level represented an approximate 9% decline from the 1970 average earning of $6,695.

Finance, Insurance and Real Estate (FIRE). Like the retail sector, the FIRE sector in Reno provides services for a wide geographic hinterland. FIRE employment increased from 3,100 in 1970 to 5,400 in 1978, an overall increase of 74% and an average annual increase of 7.2%. This growth rate was slightly below that of overall employment.

Earnings in the FIRE sector averaged $10,975 in 1976, seventh among the nine major Reno economic sectors.

Wholesale Trade. Like the transportation sector (page A-12), wholesale trade in the Reno SMSA has fournished as a result of the area's location near west coast markets and the state's favorable tax laws. Since 1970, the facilities available for warehousing, distributing and related light manufacturing have expanded at an annual rate of one million square feet; a recent estimate of total occupied space counted 15 million square feet with an additional 1.6 million square feet added upon the opening of the J.C. Penney retail catalogue warehouse. Current construction is estimated to total about 1,300,000 square feet, including the 500,000 square foot General Motors warehouse and the 350,000 square foot Thrifty's warehouse. Employment in this sector grew from 3,100 in 1970 to 5,200 in 1978, an average rate of 6.7% per year and an overall increase of nearly 68%. Average earnings in this sector were high in 1976 at $13,632.

Non-Basic Industries

Non-basic industries are those which have location quotients of less than 1.0; that is, they serve primarily the residents of the local area (in this case, the Reno SMSA) and do not bring income into the area from outside. The only such sectors in the Reno economy are agriculture, agricultural services, mining, government and manufacturing. The first three sectors together account for approximately one percent of the county's employment and therefore will not be discussed here.

Government. Although Reno is the largest city in northern Nevada and serves as a retail and FIRE center for the surrounding rural area, it does not fulfill the same function in government services. It is likely that the proximity of the state capital, Carson City, acts to shift some federal government offices which would otherwise locate in Reno to the capital, and their location in Carson City more than counteracts the location in Reno of some state offices, such as the courts.

Employment in government grew from 10,100 in 1970 to an estimated 14,400 in 1978. The increase of 4,300 jobs (43%) represented an average annual growth rate of 4.4%. This rate was lower than that of the total job base, and government's share of jobs in the Reno SMSA therefore decreased from 17.8% in 1970 to 13.8% in 1978.

Earnings in the government sector averaged $11,359 in 1976, placing that sector sixth out of nine.

Manufacturing. Manufacturing's low location quotient reflects the minor role this industry has historically played in the Reno economy. It is, however, a rapidly growing sector: increasing by 5,000 jobs (172%), from 2,900 to 7,900, between 1970 and 1978, it grew from 5% to 7.6% of the region's total jobs. Its 13% average annual growth rate was nearly double that for the total job base.

This rapid growth reflects a trend for firms which originally located warehousing and distribution activities in the Reno SMSA to establish production facilities there as well. This trend was encouraged by the 1969 liberalization of the state's Free Port Law; that change added manufacturing to the list of operations through which personal property in interstate transit retains its tax exemption. From 1976 to 1978 alone, the Greater Reno Chamber of Commerce's list of firms which manufacture, fabricate or assemble durable goods in the Reno area grew from 50 to 75 entries.

It should be noted that a low location quotient for manufacturing does not imply that the Reno SMSA necessarily consumes all the manufactured goods that are produced there, but rather that the area imports more goods than it exports.

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Summary of Recent Economic Trends

Overall, employment in the Reno SMSA grew at an average annual rate of 7.9% between 1970 and 1978, increasing by 47,700 jobs (84%). Estimates of employment by industry in 1970 and 1978 are presented in Table A-10. Also presented are the numeric increase and average annual growth rate for each sector. Industries are listed in order of their contribution to the overall increase in employment.

Table A-10 indicates that the service industry accounted for the greatest numerical increase in employment during the period; in fact, of the 19,600 jobs added, 9,400 were added in 1978. This growth spurt is attributable to the completion of the MGM Grand Hotel (1,015 rooms, about 3,400 employees) and other major hotel/casino developments including the Sahara Reno (610 rooms), Fitzgerald (345 rooms), Onslow (182 rooms), Comstock (173 rooms) and El Dorado (300 rooms added to 282).

Services, government and retail trade remained the largest three employers throughout the 1970-78 period, but the relative importance of other sectors changed significantly. Construction and manufacturing increased their shares of total employment while transportation-public utilities, FIRE and wholesale trade declined.

Table A-11 presents estimates of total personal wage and salary income derived from the various sectors of the Reno economy in 1970 and 1976. It shows that the services sector comprised the major source of personal income throughout the period and that manufacturing and wholesale trade posted the greatest percentage gains. Government and transportation-public utilities also gained in relative importance while construction, retail trade and FIRE declined.

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Table A-10

EMPLOYMENT GROWTH IN RENO SMSA 1970 TO 1978, BY INDUSTRY[1]

Industry	Employment				Increase	
	1970		1978			
	Number	% of Total	Number	% of Total	Number	Average Annual Growth Rate
Services	19,600	34.6	39,200	37.6	19,600	9.1
Trade	12,500	22.1	21,400	20.5	8,900	7.0
Wholesale	3,100	5.5	5,200	5.0	2,100	6.7
Retail	9,400	16.6	16,200	15.5	6,800	7.0
Construction	3,500	6.2	8,700	8.3	5,200	12.1
Manufacturing	2,900	5.1	7,900	7.6	5,000	13.3
Government	10,100	17.8	14,400	13.8	4,300	4.5
FIRE[2]	3,100	5.5	5,400	5.2	2,300	7.2
Transportation and Public Utilities	4,700	8.3	6,800	6.5	2,100	4.7
Mining[3]	200	.4	500	0.5	300	12.1
TOTAL	56,600	100.0	104,300	100.0	47,700	7.9

na: not available

[1] Total nonagricultural employment.

[2] Finance, insurance and real estate.

[3] Primarily sand and gravel extraction.

Source: State of Nevada, Employment Security Department, annual Reno SMSA employment summary. Figures for 1978 are preliminary estimates

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Table A-11

TOTAL PERSONAL WAGE AND SALARY INCOME BY INDUSTRY[1]
RENO SMSA, 1970 TO 1976
(thousands of dollars)

	Personal Income				
	1970		1976		%
Industry	Amount	% of Total	Amount	% of Total	Increase
Services	166,197	33.7	255,295	31.3	53.6
Trade	92,977	18.9	156,342	19.3	68.2
Wholesale	28,544	5.8	53,491	6.6	87.4
Retail	64,433	13.1	102,851	12.7	59.6
Construction	46,294	9.4	66,993	8.3	44.7
Manufacturing	26,123	5.3	56,417	7.0	116.0
Government	81,084	16.4	144,648	17.8	78.4
FIRE[2]	31,666	6.4	41,501	5.1	31.1
Transportation and Public Utilities	46,280	9.4	85,832	10.6	85.5
Mining[3]	2,614	.5	4,905	.6	87.6
TOTAL	493,235	100.0	811,933	100.0	64.6

[1] Nonagricultural sectors.

[2] Finance, Insurance and Real Estate.

[3] Primarily sand and gravel extraction.

Source: Bureau of Economic Analysis, Personal Income By Major Sources, 1969-76 (Table 5.00), Washoe County, Nevada

Chapter 2

RENO'S ECONOMIC FUTURE

The preceding chapter concludes that the Reno economy, measured by the number of jobs, grew at an average annual rate of 7.9% between 1970 and 1978. That growth was paced by the service, retail and manufacturing sectors. The overall growth rate during the period was significantly greater than that experienced during either 1960-70 (6.6%) or 1950-60 (6.1%).*

What about the future? Will Reno's economy continue to grow at the rate evidenced during the 1970's, or will it slow to or below historic trends? This chapter looks at the prospects for future growth in each of the sectors discussed in Chapter I, at projections of "unconstrained" economic growth that have been prepared for other agencies and the potential constraints on future economic growth. It concludes with a description of the economic growth projection that will be used as a basis for the EIS forecasts of population and land use.

Prospects for Future Growth

The amount of growth experienced by each economic sector in the future will be influenced by a variety of factors. Basic industries will be influenced most strongly by national economic conditions and possibly by political forces while non-basic industries will be influenced mainly by the rate of local population growth and by local economic conditions. The following paragraphs review the likely effects of such influences on the respective sectors of the Reno economy.

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*Employment estimates for 1950, 1960 and 1970 from Dahl, Albin J., "Nevada's Economic Development: An Overview" in Nevada Review of Business and Economics (Volume 2, No. 2) Summer 1978, p. 14.

Basic Industries

Services. The visitor-gaming-tourist industry, which has spearheaded recent growth in the services sector, appears likely to continue its recent expansion pattern. Approximately 1,000 new hotel rooms are expected to become available in 1979 with the opening of the Sands and the Sundowner; MGM Grand Hotel is planning an addition of 940 rooms if city approval and sewer capacity are forthcoming. The hiring of new employees for the Sands and the Sundowner is expected to make services the fastest-growing sector in 1979, with a predicted 10.2% increase; the estimated 3,800 new employees will represent 55% of all new jobs in Reno.

Longer-range patterns are more difficult to estimate. Observers of the Reno economy suggest that the gaming industry there has reached a scale at which it will not be adversely affected by national economic downturns short of a major recession, and that the saturation point for gaming activity has not yet been approached. (The win-per-gaming-device in Reno has remained constant through the recent expansion of activity there, strongly suggesting that the saturation point of development has not yet been reached.) They also suggest that prospective gamblers have come to view the Reno-Tahoe area as a "two-for-one" combination and consequently many prefer the joint gaming opportunity there to Las Vegas' single locale. There are, however, no forecasts of potential future gaming activity, and weekday activity in some casinos in winter 1978-79 was slow enough that operators asked the State Gaming Control Board for permission to close during the week.

One method of estimating future gaming employment - the cornerstone of future services employment - in Reno is to compare it to another economic indicator which is known or estimated for the period in question. For example, historical hotel-gaming employment in Reno may be compared to historic statewide employment to determine whether there is any correlation between the two; if there is, then an estimate of future gaming jobs can be derived from forecasts of future statewide employment. In the case of the Reno SMSA, data for 1967-77 indicate a strong correlation between the two, with variations in statewide employment explaining approximately 95% of the variation in local hotel-gaming employment. The identified relationship indicates that of every 100 jobs added in Nevada, nearly eight (7.76) will be in the Reno SMSA hotel-gaming sector. It must be recognized, of course, that the Reno hotel-gaming sector's contribution to statewide employment has an influence on it and contributes to the strong correlation between the two.

Construction. The growth of the contract construction industry is inextricably tied to growth in other sectors; that is, construction will be needed only if other activities require new structures or additions to old ones. Thus, construction of the Sands and Sundowner hotel/casinos and related projects will provide jobs in 1979; additional future jobs, however, may be dependent on the amount of development permitted by contemporary water supply and wastewater treatment capacity.

Transportation and Public Utilities. The transportation sector is likely to continue its recent growth trend, aided by Nevada's Free Port Law and the proximity of the Reno area to major west coast markets. Recent construction of major warehousing facilities for large retailers in both Sparks and Stead support this hypothesis, as they will require transportation support for collection and distribution of goods.

The public utilities sector may be expected to grow according to local residential, commercial and industrial demand.

Retail Trade. Because of its strong links to visitor and permanent population increases, Reno's retail sector will continue to grow in the future. Currently planned retail additions include the remainder of the Meadowood Mall and four other centers.

As the nature of hotel/casino operations changes, though, the nature of retailing in the Reno SMSA may also change. Retail stores - and especially restaurants and clothing stores - have historically benefited from the "spillover" effects of hotel/casino operations, when visitors left the hotel or hotel/casino operations, when visitors left the hotel or traveled among casinos and stopped en route to eat and shop. While the hotel/casinos have historically provided restaurants and coffee shops, they have only recently begun to include retail stores designed to capture visitors' demands and keep the visitors in the casinos. The effect of this change on other retail establishments is not yet known: it could either generate its own demand, thus adding to the volume of local retail trade, or shift some of the demand that would have been present anyway away from other outlets into the hotel/casinos. (In the latter case, the amount of growth in retail trade would probably not be significantly affected, but the nature of that growth - tending toward larger, chain-store establishments and specialty stores rather than smaller, proprietor-operated and general merchandise shops - may be affected.)

Finance, Insurance and Real Estate (FIRE). The FIRE sector will continue to serve not only the Reno SMSA but also the growing population of the surrounding counties. Most demand may be expected to be generated locally; the export portion of the sector will cater to the outlying areas.

Wholesale Trade. While location and tax laws continue to make the Reno area an attractive place for warehousing, distributing and related light assembly, competition for resources such as labor and land have recently driven the costs of those resources up sufficiently to prompt firms to look for sites in neighboring areas. With the recent growth of the visitor-gaming-tourist industry, the local unemployment rate has dropped to a low level, enabling workers to raise their wage demands. Land has also become less available, and prices are estimated to have doubled since 1975.

Despite these conditions, expansion of about one million square feet per year is expected by knowledgeable local sources to continue for the next 5 to 6 years. Of the space added, about 75% will be devoted to warehousing.

Non-basic Industries

Government. Growth in government employment in Washoe County will depend on several factors: the demand or need for added government services as population grows, the effect of Nevada's spending limitation law on the number of government jobs and the propensity of state offices to locate in Reno rather than Carson City. The spending limitation law may prove to be the controlling factor.

Manufacturing. As noted in Chapter 1, the low location quotient for manufacturing does not imply that the Reno SMSA necessarily consumes all the manufactured goods that are produced there - which would closely tie growth in manufacturing to growth in population - but rather that the area imports more goods than it exports. The amount of exports, and therefore the number of manufacturing jobs, may be expected to continue to grow if the Free Port Law continues to cover intermediate assembly of goods within the state. Reno's strategic location will also make it a desirable area for assembly of goods whose components come from different areas of the west.

Forecasts of Economic Growth

In order to be helpful in forecasting population and land use conditions, these prospects for future growth must be quantified. Several agencies have developed numeric estimates of the number of jobs that will be available in future years. These estimates differ in both the methodologies used to derive them and in their results. Two of the projections - those prepared by the U.S. Department of Commerce Bureau of Economic Analysis (BEA) and the Nevada State Planning Coordinator's Office (SPC) - have been published; the third, prepared by Sierra Pacific Power Company (SPPCo) has not been published and only its methodology is presented here. All three forecasts are "unconstrained" projections; that is, they implicitly assume that there will be no physical or political constraints on the economic growth they anticipate.

Forecast by the Bureau of Economic Analysis (BEA)

Background. The Bureau of Economic Analysis (BEA) is an agency of the U.S. Department of Commerce which prepares a comprehensive set of subnational economic projections as part of its regular work program. BEA directs the preparation of the population and economic projections known as the OBERS projections - an acronym reflecting a joint effort by BEA (formerly the Office of Business Economics) and the Economic Research Service of the U.S. Department of Agriculture.

The OBERS projections include estimates of future economic activity for the nation, for 173 economic subareas, for 20 water resources regions and 205 water resources subareas, for states, for 253 standard metropolitan statistical areas (SMSAs) and for non-SMSA portions of economic areas and subareas. The OBERS approach thus requires that projections for economic and smaller subareas aggregate to equal the national forecast total.

The most recent full OBERS projection was completed in 1972 and published in 1974 (BEA, 1974). The projections include population, personal income, and employment and earnings of persons by industry. The years covered are the fifty years between 1970 and 2020, with projections specified for 1980, 1985, 1990, 2000 and 2020.

Approach. The OBERS projections rely on comparisons between national and regional economic patterns to yield estimates of the share of future national economic activity that will occur in a given region such as Washoe County. To make these comparisons, OBERS begins with indices of regional specialization, which may be calculated as follows:

$$\begin{array}{c}\text{Index of}\\ \text{Regional}\\ \text{Specialization}\end{array} = \begin{array}{c}\text{Industry's Share}\\ \text{of Regional Personal}\\ \text{Income from}\\ \text{Earnings}\end{array} - \begin{array}{c}\text{Industry's Share}\\ \text{of National Personal}\\ \text{Income from Earnings}\end{array}$$

For example, in 1975 "lodging and personal services" accounted for 12.8% of earnings in Nevada and only 1.4% of earnings in the U.S. as a whole; therefore, the index of regional specialization for Nevada was 11.4. (Thus, the index of regional specialization is generally similar to the calculated basic component of an industrial sector, because both are measures of comparison between the regional and national industry shares.)

The index of regional specialization for each industry is combined with data on national earnings by industry to derive the industry's income location quotient. The location quotients are then used to estimate each industry's percentage contribution to total regional income, and these estimates are combined with the data on national earnings by industry to approximate regional earnings by industry.

For basic industries, these earnings projections are then compared to employment projections derived from a modified shift-share analysis. Shift-share analysis is based on the assumption that the region's future employment in a certain industry may be estimated by looking at its historic share of the nation's employment and the historic growth or decline of the industry in the region. Discrepancies between the earnings and employment projections are then resolved.

For non-basic industries, employment estimates are derived using the same procedure as for income, and discrepancies between the two estimates are then resolved.

Results. The published OBERS projections include only employment totals rather than industry-by-industry figures. Presented in Table A-12, they anticipate that the number of jobs in Washoe County will grow to 95,100 by 1990 and 141,600 by 2020, an average annual growth rate of about 2.9% between 1970 and 1990 and a rate of about 2.0% between 1970 and 2020.

Table A-12

OBERS PROJECTION OF EMPLOYMENT
IN THE RENO SMSA

Year	Total Employment	Average Annual % Growth
1950*	20,740	
1960*	36,527	5.8
1970*	53,830	4.0
1980	75,000	3.4
1985	84,400	2.4
1990	95,100	2.4
2000	114,800	1.9
2020	141,600	1.1

*Included for reference only.

Source: U.S. Water Resources Council, 1972 OBERS Projections, Volume 5, Table 1. Average annual growth calculated by Gruen Gruen + Associates.

It should be noted that this projection was prepared in 1972, prior to the growth spurt that began in Reno in the latter half of the decade, and therefore does not anticipate or reflect that growth.

Forecast by Sierra Pacific Power Company (SPPCo)

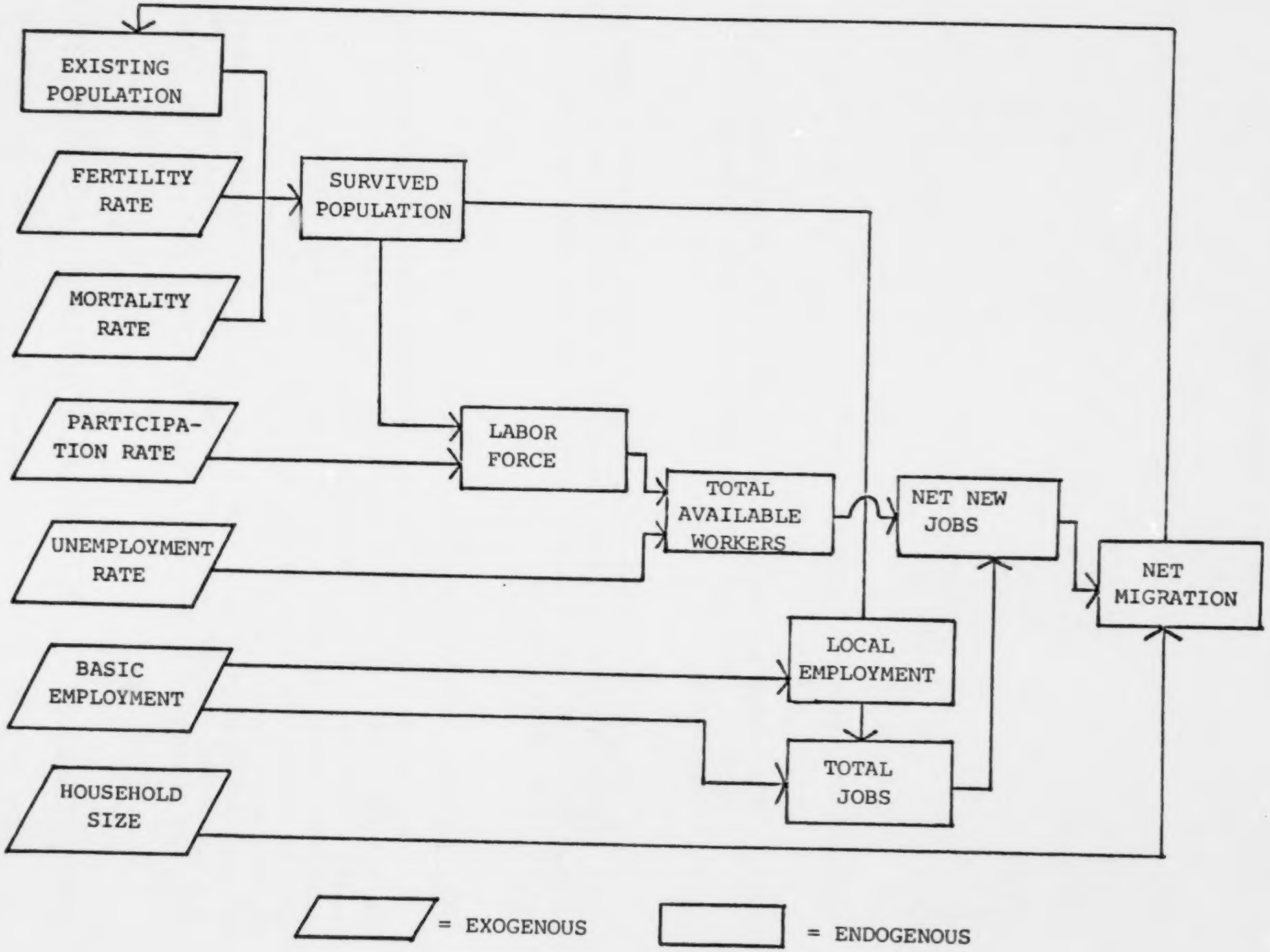
The Sierra Pacific Power Company (SPPCo) model forecasts employment as one step toward forecasting population. The model combines an exogenously developed estimate of basic employment with an estimate of local-serving employment (based on the existing population and the level of basic employment) to project total jobs. The structure of the model is displayed in Figure A-1. The resulting employment forecast has not been published, but the population forecast anticipates 194,783 Washoe County residents in 1980, 268,261 in 1990.

Forecast by the State Planning Coordinator's Office (SPC)

The SPC forecast is a baseline projection generated by a computer-assisted model ("Demographic and Economic Impact Simulation Model," or DEISM) on a county-by-county basis for aggregation to state totals. The model uses population inputs,

FIGURE A-1

SIERRA PACIFIC POWER COMPANY EMPLOYMENT - POPULATION MODEL


EXISTING POPULATION
FERTILITY RATE
MORTALITY RATE
PARTICIPATION RATE
UNEMPLOYMENT RATE
BASIC EMPLOYMENT
HOUSEHOLD SIZE
SURVIVED POPULATION
LABOR FORCE
TOTAL AVAILABLE WORKERS
NET NEW JOBS
LOCAL EMPLOYMENT
TOTAL JOBS
NET MIGRATION
= EXOGENOUS
= ENDOGENOUS

Source: SPPCo, 1978

derived from cohort-survival and migration assumptions,[1] and estimates of basic employment to project total employment by sector and some labor force characteristics. The estimates of basic employment used were derived exogenously by SPC and State Employment Security Research (ESR) staff for 77 industrial categories, and then collapsed into the ten broad industrial sectors.

Important assumptions built into the SPC models are that fertility and survival rates, household head characteristics and propensities to migrate will remain as reported in the 1970 Census; that the labor force participation rate, level of multiple jobholding, net in- or out-commutation and employment location quotients by industry will remain constant; and that migration which is unrelated to employment - e.g., by students and retired persons - will vary from year to year. The number of non-farm proprietors, such as self-employed workers and others not covered by unemployment insurance, is forecast separately from the other industrial sectors.

The resulting SPC forecast for employment is presented in Table A-13. It shows an increase in total employment from 62,676 in 1970 to 197,100 in 1990, an average annual growth rate of 5.9%. When disaggregated into five-year components, the forecast anticipates average annual growth rates of 9.7% during 1975-80, 5.0% during 1980-85 and 3.8% during 1985-90.

Comparison of BEA and SPC Forecasts

The BEA (OBERS) and SPC employment forecasts are compared in Figure A-2. The comparison illustrates a sharp contrast between the two. This contrast may result from any of a number of factors, including (1) a different estimate of employment in 1970, (2) the top-down (OBERS) versus bottoms-up (SPC) approach, (3) differing assumptions about the growth rates for basic industries and (4) differing assumptions about the relationship among basic employment, non-basic employment and population.

Conparison of SPPCo and SPC Forecasts

The SPPCo forecast may be compared to the SPC forecast by looking at the population projected by the respective models (because the SPPCo forecast does not include published employment estimates). This comparison is presented in Figure A-3.[2]

[1] Methodologies for population projection are discussed in Subappendix Al.

[2] More detailed discussions of population projections may be found in Chapter 3 and Subappendix Al.

Table A-13

SPC (DEISM) EMPLOYMENT PROJECTIONS

Industry	Employment 1970	1975	1980	1985	1990	Increase %	Average Annual Growth Rate
Services	21,208	28,070	47,720	61,550	73,220	245	6.4%
Trade[1]	12,579	16,380	24,720	31,700	38,040	202	5.7%
Construction	3,531	3,787	5,810	6,991	8,086	129	4.2%
Manufacturing	2,901	4,872	8,456	11,730	14,850	411	8.5%
Government	9,313	11,870	19,350	24,480	30,500	227	6.1%
FIRE[2]	3,169	3,925	5,809	7,646	9,510	200	5.6%
Transportation and Public Utilities	4,593	5,624	7,398	8,859	10,200	122	4.1%
Non-farm Proprietors	4,715	5,102	7,801	9,633	11,530	145	4.6%
Other[3]	687	887	1,031	1,176	1,192	74	2.8%
TOTAL	62,676	80,510	128,100	163,800	197,100	214	5.9%

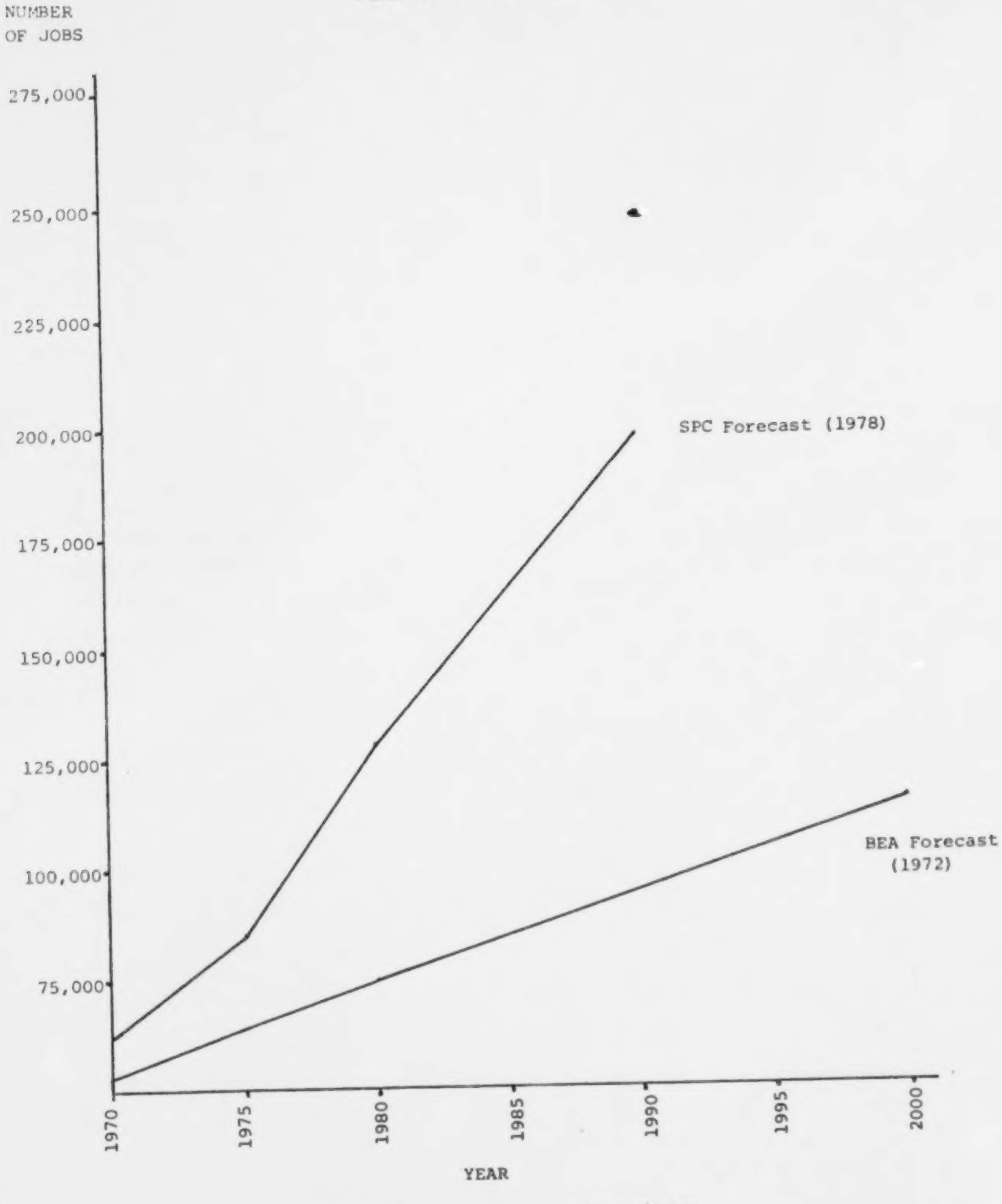
[1] Wholesale and retail trade.
[2] Finance, insurance and real estate.
[3] Agricultural services and mining.

Source: Governor's Office of Planning Coordination, Nevada's Demographic and Economic Impact Simulation Model, Model Description and Baseline Projections, December 1978.

The two forecasts, developed completely independently of each other, are very similar through 1990; they estimate a difference in population of less than two percent at that time. This similarity acts to validate not only the population estimates but also the underlying economic/employment estimates. It also suggests that the economic assumptions used by the two agencies are similar.

Figure A-2

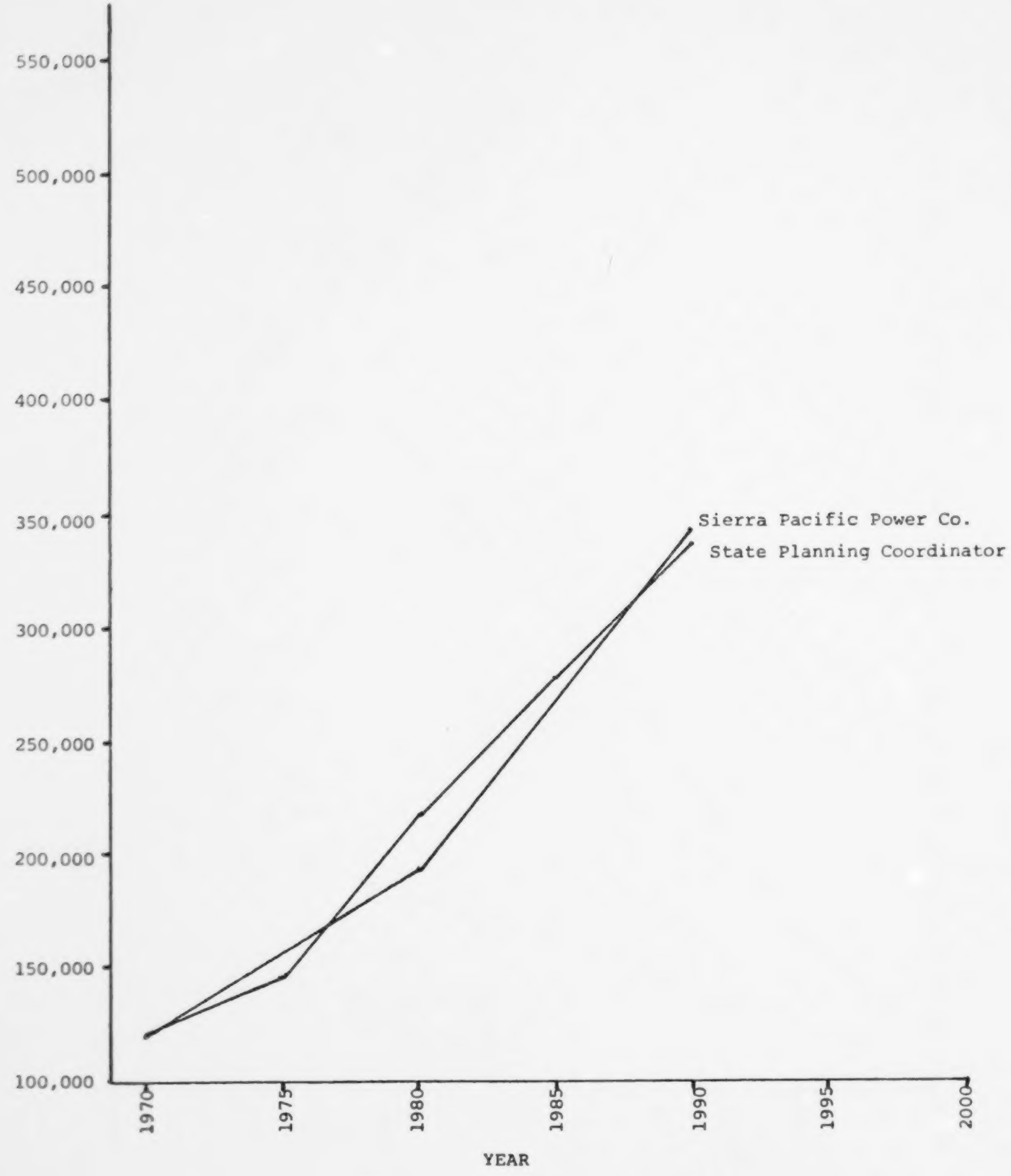
COMPARISON OF BEA AND SPC EMPLOYMENT FORECASTS FOR WASHOE COUNTY



Source: Gruen Gruen + Associates

Figure A-3

COMPARISON OF SPPCo AND SPC POPULATION FORECASTS FOR WASHOE COUNTY



Source: Gruen Gruen + Associates

Potential Constraints on Future Economic Growth

The SPC (and, by comparison, the SPPCo) projection presented in the previous section is the result of a sound economic approach to baseline forecasting. The baseline forecast is one which recognizes no exogenous (non-economic) incentives to or constraints on the economic growth of a region. It thus establishes a basis, or baseline, for comparing and evaluating such incentives and constraints.

Nevertheless, there have always been such exogenous influences on growth, and there will continue to be in the future. In the past, they have acted both to encourage and discourage economic development; for example, the lack of unique resources before gaming was legalized inhibited growth, but more recently legal gaming and the state's liberal Free Port Law have combined to stimulate the growth of an unusual economy.

Just as the regional context has encouraged economic growth in the past, though, it may contain elements that will act to constrain growth in the future. The lack of additional wastewater treatment capacity, a problem addressed by this EIS, is one such element, but there are others as well. Some of them are described below.

Limited Water Supply

Water is supplied to Reno and Sparks by the Sierra Pacific Power Company. According to the Land Use Plan (for Truckee Meadows, Washoe County, Nevada) published by the Regional Planning Commission, SPPCo's current and expected future water supply is sufficient to serve 220,000 people. The plan estimates that the population of the water service area was 142,315 as of April 1978; thus, if the water service area is not expanded and no new supplies are acquired by SPPCo, growth in the water service area will be limited.

In the portion of Truckee Meadows not served by Sierra Pacific, water is provided by Hidden Valley Water COmpany, TransSierra Water Company or wells. Although the ultimate service capabilities of these two companies has not been published, neither is likely to have capacity for a significant amount of additional growth. Wells are sufficient for residential service but are not likely to be feasible for commercial or industrial service.

Rising Price of Industrial Land

The recent and continued growth of manufacturing and warehousing activity in the Reno-Sparks area has generated both a high level of demand for industrial land and a shortage of it. With no new land being added to the supply, prices for remaining usable parcels approximately doubled between 1975 and 1979. This sharp increase has discouraged some firms from locating in Reno-Sparks and prompted them to look for sites in nearby cities - for example, Fernley and Fallon - instead.

Labor Shortage

One of the factors that has attracted firms to Reno in the past has been the presence of a large labor force available at relatively low wage rates. The recent growth spurt has changed that situation, though; unemployment dropped from its 1970-77 average of about 6% to about 2.4% in August 1978, rising to 3.2% in May 1979. These figures may be compared to the conventional economic assumptions that a 4% unemployment rate represents full employment. The low unemployment level puts workers in a strong position to demand higher wages than they have previously been paid.

Housing Shortage

The workers' incentive to demand higher wage rates lies partly in the shortage of housing in the Reno area. Even though the area's recent employment growth has prompted an increase in residential construction, the number of dwelling units built has not kept up with demand. Between 1966 and 1976, residential construction averaged about 2,000 units per year; between 1970 and 1978 the average rose to almost 3,800 units per year, as shown in Table A-14. Even this increased rate of housing production did not keep pace with the increase in employment, as indicated by Table A-15.

The result of this imbalance has been a recent prevalence of low (less than 1%) vacancy rates and, since mid-1977, soaring housing prices; between mid-1977 and mid-1978, the price of the least expensive new single family home increased 34%, reaching $47,000 in June 1978.

This housing crisis has reportedly contributed to a variety of related problems, including overcrowding, deterioration of the housing stock, rent-gouging, and very probably an increase in in-commuting, as people try to lower their housing costs by choosing units in remote locations. A particular shortage of moderately-priced rental units is causing hardship to a great many households.

Table A-14

HOUSING UNITS AUTHORIZED BY BUILDING PERMITS RENO, NEVADA SMSA 1970 - 1978

Year	City of Reno	City of Sparks	Rest of Washoe County	Reno SMSA Total
1970	1,058	335	716	2,109
1971	2,015	925	973	3,913
1972	1,947	1,769	844	4,560
1973	1,591	1,012	731	3,334
1974	505	365	293	1,163
1975	607	373	348	1,328
1976	2,868	1,178	556	4,602
1977	3,503	1,006	1,484	5,993
1978	4,004	1,251	1,813	7,068
Annual Average	2,011	913	862	3,786

Source: U.S. Department of Commerce, Bureau of the Census, Housing Authorized by Building Permits and Public Contracts (Series C40); local building departments.

Table A-15

INCREASES IN POPULATION, EMPLOYMENT AND HOUSING UNITS, RENO SMSA, 1970-78

	Population	Employment[1]	Housing Units
1970	121,068	56,600	44,722
1978	176,368	99,700	71,724[2]
% Increase	45.7	76.1	60.4

[1] Non-farm employment.

[2] Based on units counted in the 1970 Census plus units permitted in 1970-79.

Source: Population: 1970 data from U.S. Census of Population, 1978 data from State Planning Coordinator; Employment: 1970 and 1978 data from Table A-10; Housing Units: 1970 data from U.S. Census of Housing, 1978 data from 1970 U.S. Census of Housing and Table A-14.

Traffic Congestion

Population and economic growth in the Reno-Sparks area have brought new automobile traffic with few improvements to the major street network. As a result, major routes are crowded throughout an extended rush hour and at some other times during the day. Traffic conditions such as these also reduce the attractiveness of the area to potential movers-in.

The constraints described here will influence the ability of the Reno economy to achieve the amount of growth forecast by the State Planning Coordinator's Office. The degree to which they are allowed to operate or are resolved will affect not only the potential increase in employment but also, indirectly, the estimated increases in population and housing units that are described in the next two chapters.

CHAPTER 3

FUTURE POPULATION GROWTH

This chapter sets forth the population forecast to be used on a preliminary basis in the evaluation of environmental impacts of the proposed Reno/Sparks JWPCP wastewater facilities. First, the purposes of population forecasting work are described and the reasons for using an economic approach to estimating population growth are summarized. The second section of the chapter outlines the principal environmental and development conditions which affect future population growth (and forecasting) in the study area. Finally, the forecasting strategy being implemented in this EIS is described, and steps to complete the population analysis are indicated.

Purpose

Applications of Population Forecasts

Population forecasting is one of the standard activities of planning and public works agencies. Population forecasts provide the basis for the sizing of major capital facilities such as water lines, sewer interceptors and roads - facilities requiring significant capital investment and designed for very long run use. Constructing facilities excessively large would require a commitment of resources that might otherwise have been available for other public purposes. Facilities which prove to be too small, on the other hand, may be expandable only at costs which greatly exceed what they would have been if needed capacity had been built initially. Accurate timing and sizing decisions depend upon accurate population forecasting.

Planning for provision of public services - public safety, education, recreation, public administration - also relies upon a knowledge of future population and development. This is particularly true of the land-related activities of government. For example, is enough residentially-zoned land going to be available to meet housing needs of the community? What are the site acquisition needs relating to fire stations, school buildings and parks that will serve new residents?

The description of the region's future population growth presented in this chapter draws upon a review of a variety of population projections and forecasts, most of which are set forth in Subappendix A1. The purpose of this review has been to select or develop a plausible year 2000 population range for the Truckee Meadows appropriate for the forecasting and evaluating of secondary impacts of growth which may result from the proposed expansion of the Reno/Sparks Joint Water Pollution Control Plant. A reasonably accurate range estimate of future population is essential to the environmental assessment task - a task required under the provisions of the National

Environmental Policy Act for projects funded in whole or in part by federal funds.

The particular applications of population forecasts most relevant to this EIS relate to wastewater treatment facilities (type, collective capacity and adequacy in terms of meeting water quality standards), future air quality conditions and the adequacy of the water supply to serve future growth.

Consistency of Population Forecasts with Local Planning Activities

A major investment in a public facility - in this instance, a regional wastewater treatment plant - carries with it a series of implications with regard to other public investments, local and (possibly) state and federal. These would include directly related facilities such as collector and interceptor sewers. Also included would be a variety of other facilities: water pipelines, street and road networks, schools, open spaces and other publically-funded facilities to serve the growing population accommodated by the wastewater plant expansion.

It is important that public funds be allocated to such functions in an efficient manner. That means, among other things, that the capacity of any one system should not greatly exceed the known or potential capacity of other facilities and services, or the capacity of the land itself to accommodate growth. To provide wastewater treatment capacity in excess of what would be needed to serve the maximum development supportable by an area's water resources would be imprudent. Similarly, it is a poor use of public funds to construct any facility significantly larger than will be needed to serve the maximum population the remaining developable land in an area can accommodate. Finally, efficient use of public funds involves coordinated planning for public facilities: to permit a large increase in wastewater system capacity while making no provision for transportation improvements means that the quality of services will decline.

For all these reasons, the evaluation of a public capital investment must take into consideration the context of the proposed facility, and its interrelation to other resources and services. One of the purposes of an environmental impact statement is to identify apparent inconsistencies between the project (scale, type of facility, timing, level of service) and plans for future public and private development, both to help assure that the specific project selected is best suited to the context and to take cognizance of planning and other public activities that would improve the "fit" between the project and the area it will serve.

Economic Approach

In fast-growth areas such as west central Nevada, inmigration is the dominant source of population growth. The region's job base has grown very rapidly in recent years, and this expansion has attracted new residents to Reno and to neighboring counties.

To forecast the region's population, it is useful to consider first what future job growth will be. Two of the population forecasting approaches which have been applied to Washoe and other Nevada counties in the last few years have incorporated into the estimation of future population forecasts of regional economic growth on the premise that job creation is the major attractant of new residents. These forecasts - one by the State Planning Coordinator and one by Sierra Pacific Power Company - have been described in greater detail in Chapter 2.

Of course, job growth is not the only cause of population growth. Some new jobs may not result in inmigration at all: they may be filled by someone who was previously not in the labor force (a second wage earner or a person just out of school) or by someone who had previously been on the unemployment rolls. Furthermore, some population growth is not a consequence of job creation. Retirement moves are a good example.

Notwithstanding these limitations, a sound economic forecast generally provides the best basis for population forecasting in fast-growth areas, and is the approach adopted in population analysis in this EIS.

The Context of Washoe County Growth

The previous chapter pointed out that additions to the housing supply in Washoe County have not kept pace with the increase in employment. While employment has grown by 70% since 1970, the number of housing units in Washoe County grew by only 60%.

The Washoe Housing Shortfall and Spillover

The housing shortfall has resulted in increased incommuting by persons with jobs in Truckee Meadows and housing units elsewhere. The movement out of Truckee Meadows has been prompted both by limited housing availability and by the fact that housing costs (prices and rents) have been rising faster in the Reno/Sparks area than elsewhere in west central Nevada. Interviews with government staff and developers in Lyon and Churchill Counties revealed that prices for comparable housing units range from 15 percent to 30 percent lower in the Fernley, Yerington and Fallon areas than in Reno. Such a significant difference in housing costs compensates commuters for the cost and inconvenience of lengthy commutes.

The situation just described is referred to as "spillover": the demand for housing by Truckee Meadows workers has spilled over into neighboring counties. For this reason, it is not possible to analyze or forecast Washoe County's economy and population independently of its neighboring counties. Spillover development requires consideration of growth pressures and patterns on a regional basis.

Incommuting to Washoe from Outlying Counties

The population forecasts developed by the State Planning Coordinator and by Sierra Pacific Power Company do not take spillover development into consideration. Implicitly, they assume that job growth in Washoe County will be matched by population growth in Washoe County in historic proportions. Although local observers generally agree that the proportion of Washoe jobs held by incommuters has increased markedly in the last five years, this circumstance is not reflected in the SPC and SPPCo forecasts, which means that those forecasts very likely *over*estimate Washoe's short-run population growth and *under*estimate the population growth in neighboring counties supplying Washoe with workers.

Commute Data Inconclusive. Changes in commute patterns over time would probably be the most direct measure of spillover. Measures of change in commutation are unfortunately not readily available. Data from the 1970 Census show that net incommuting into Washoe County (the number of incommuters less the number of outcommuters) was in the range of 2,500 to 3,000, which would have been about half a percent of the jobs in the county - not a very significant number.

More recent data - up to 1978 - do not support the hypothesis of massive incommuting. Data from the Department of Highways on traffic counts on key access routes (U.S. 395 north and south and I-80 east and west) show December 1978 inbound and outbound flows during peak hours as about equal except on 395 north of Reno, which is the route serving Lemmon Valley and Stead. Counts at Stateline are more suggestive of a net outcommute. Counts at Lakeview (395 south of Reno) appear to show a very small net incommute from the direction of Carson City, while counts at Vista are inconclusive.

Casino Employment Data Not Suggestive of Sizable Incommute. Major Reno/Sparks employers were queried on this question and half a dozen casinos provided information indicating that over 80 percent of their employees have Reno or Sparks zip codes. Of the rest, about 1 percent live to the north (e.g., Sun Valley, Doyle), 11 percent live to the south (Steamboat, Crystal Bay, Carson City, Minden), 2 percent live to the west (Verdi, Truckee, Tahoe City) and 5 percent to the east. These data do not necessarily suggest a large incommute, since only the south provides over 10% of the employees and Reno/Sparks and Carson City are said to have a large cross-commute.

Too Soon to Detect Major Shifts in Labor Force/Employment Patterns in Outlying Counties. A final attempt to shed light on regional commuting patterns was undertaken by GG+A via examination of employment and labor force trends in the outlying counties. The hypothesis was that as incommuting to Reno and Sparks increased, the labor force of surrounding counties would show more rapid growth than would employment in surrounding counties. That does appear to be true for Lyon County, which reputedly has been recently receiving some of Reno's spillover growth. But 1978 employment data are not yet available by county and it is therefore too soon to make an argument (let alone project a trend) on this basis.

Spillover Estimates May Be Incorporated into Subsequent Adjustments to Population Forecast. There is substantial reason to believe that economic growth has spurred population growth in neighboring counties. The gap in housing prices between Washoe and outlying counties and developers' plans for major housing development (particularly in Lyon County) seems to insure a short-run acceleration of spillover.

The population approach which GG+A intended to implement in this study would have involved an adjustment of the SPC forecast to take spillover into account. At this time, making that adjustment is not possible due to the data deficiencies just described. However, such adjustment may be made in a future revision of this draft as more information becomes available.

Resource Constraints

One of the critical questions with regard to population forecasting in west central Nevada is the ability of the natural environment to support development.

This issue is of immediate concern in Truckee Meadows, where the exhaustion of wastewater treatment capacity poses a short-term growth constraint. Wastewater and water supply issues have also arisen in outlying areas which are present or potential recipients of Washoe spillover. Finally, both in Washoe and in neighboring counties, there is a question as to whether land resources will satisfy demand for development.

Resource questions have been explored extensively with public agency personnel and people in the land development industry. Inquiries with regard to the three major issues yielded the following conclusions:

Wastewater Treatment. In Truckee Meadows, wastewater treatment capacity and service arrangements are currently being analyzed, and solutions to the present capacity limitation, as well as to long term needs, appear to be available. [These projects will be discussed elsewhere in the report.]

Outside of Truckee Meadows, strategies for ensuring wastewater capacity tend to fall into two classes: individual on-site systems (the pattern in northern Churchill County and other rural areas) and collective systems (either municipal or developer-sponsored). In general, soil and water conditions are such that individual systems cannot support urban levels of density in Nevada. As a result, population pressures typically result in implementation or expansion of collective systems, as appears imminent in northern Douglas County and the Fernley area. When such systems are implemented, the cost of housing tends to rise, as the developer recoups the infrastructure investment (which he normally front-ends, whether operation and management of the system is ultimately public or private) by charging higher housing prices. Furthermore, densities of new housing tend to increase to help keep infrastructure costs low.

Water Supply. The long-term water capacity of Truckee Meadows has not been definitively established. Studies of this question form one element of the EIS research program, and limits which that research establishes may prove to be the determining factor in the area's ultimate population capacity. In the short run, planners and local government staff do not believe water supply will prove a limiting factor, although it is frequently noted that extension of urban services (including water) outside the defined water service area implies that development within the water service area may not reach its maximum theoretical capacity.

Outside of Washoe County, water supply conditions pose many of the same problems and choices as wastewater treatment. In many areas it is difficult to find groundwater which meets drinking water standards. Thus, collective systems which can implement blending or treatment strategies tend to be the solution to accommodating rapid population growth. These are some of the strategies being considered in Fernley. Carson City poses an example of an area whose short-term growth is constrained by water supply. Large parts of Storey County face the same problem. The fact that some of the areas closest to Reno are the same areas facing an immediate water supply constraint may explain why spillover is difficult to detect with current data: it is remote (as far away as Fallon to the east) and diffuse. Logical places for "bedroom suburbs" such as Carson have limited ability to cope with large short-run growth.

Land Resources. At first glance, land seems to be the most plentiful resource the region offers. But on closer inspection, it becomes clear that the amount of land which can support development is a far more limited commodity.

In Truckee Meadows, the Regional Planning Commission (RPC) has taken steps to inventory developable land resources by identifying such constraints on development as steep slopes, seismic risk, and flood plains, classifying the area's land supply as to its suitability for urban use. A description of the inventory and classification system is presented in Subappendix A2. A review of the plan with RPC staff and discussions with developers has led GG+A to conclude that there will not be a shortage of land suitable for residential use in Truckee Meadows in the short run (to 1990); the supply through the year 2000 seems likely to be adequate.

However, adequacy of supply is not solely a question of the amount of vacant land suitable for urban use, but of how desirable that land looks to the developers who would convert it into residential, commercial or industrial uses. As far as residential land is concerned, the attractiveness of Reno/Sparks land for development will probably remain strong as long as the job base of west central Nevada remains concentrated in the Truckee Meadows.

Diminution in the supply of industrial land in Truckee Meadows, and rising prices for the land remaining, is increasingly encouraging industrial developers to consider sites outside the Reno/Sparks area. Developers in Fernley indicate that firms drawn to their industrial sites are the same kinds of industrial firms that Reno and Sparks have typically attracted in the past. This trend is likely to continue, and the growing population base in the outlying counties (particularly Lyon and Churchill) will reinforce it by supplying a close-at-hand labor force, which Reno and Sparks are currently hard-pressed to do. Decentralization of industrial jobs and spillover of housing from Reno to outlying counties are mutually reinforcing trends. And because some of the lands closest to Reno (Washoe County north of Truckee Meadows and the vast majority of Storey County) pose very adverse development conditions, the decentralization effect is being felt over a very wide area.

Implications of Resource Constraints on Long-run Development Patterns. Housing spillover and industrial decentralization, once begun, set in motion a variety of economic forces that will tend to encourage continuing development in outlying areas. For one thing, households who live in the outlying counties and work in Reno contribute to the growth of local jobs in their residential communities by their demand for local goods and services from groceries to schools. For another, as these residential concentrations in the outlying counties grow, the same areas look more desirable to non-residential uses, basic employers being attracted by a resident labor force and non-basic employers by growing numbers of local customers.

The topography of west central Nevada - wide plateaus separated by one or more ridges - creates conditions for population dispersion which the gentler landscapes of other regions inhibit. Over the long run, if growth pressures continue to be experienced to the degree recently observed, the possibility of dispersion of a grand scale - the "Los Angelization" of west central Nevada - cannot be ignored. At this point in the EIS investigation, it is not clear to what extent resources will pose a limit to growth in the outlying counties. Water may well prove to establish that limit, because the kinds of steps Los Angeles took to assure its water supply are simply no longer possible. Road networks, too, may prove inadequate to the extensive cross-commuting which continued spillover development would bring about.

But the lack of knowledge as to when any built-in limits would take effect definitely causes concern from a regional environmental perspective, and suggests that any Truckee Meadows decisions potentially encouraging dispersion - such as movement of the airport or limitations on local employment growth - should be closely investigated for their long-term consequences on the region as a whole.

Population Predictability: Short Run vs. Long Run

Consistency of Short Run Forecasts

As was discussed in Chapter 2, two parallel but independent population forecasting efforts - those of the State Planning Coordinator and Sierra Pacific Power Company - have resulted in fairly consistent short-run population forecasts for Washoe County. The gap between the two forecasts, though about ten percent in 1980 (a difference which may be attributable to use of different years for base data) narrows to less than two percent in 1990.

Sierra Pacific also prepared forecasts for Carson City and Douglas County. In these cases, their results were more sharply at odds, with the SPC forecast much higher in Carson City and the SPPCo forecast higher in Douglas. These differences illustrate the problems of forecasting for rural and nonmetropolitan counties.

Forecasting Agencies Have Not Pushed Long-run Forecasts

There appears to be scant interest in forecasting beyond 1990. SPPCo's obligations embrace a period 15 years into the future. While both the SPPCo and the SPC models are technically capable of forecasting to the year 2000, neither group has published an official forecast. The SPC model documentation is complete through 1990, but does not discuss the year 2000 estimates the agency published in October 1978. Some of the possible reasons why longer-run forecasting for west central Nevada does pose problems are discussed in the next sections of this chapter.

Conditions Affecting Inmigration a Key Variable

Both the SPC and the SPPCo population forecasting models are employment-driven; that is, a forecast of economic growth provides the main input into calculations of population change.

Many factors influence the level of inmigration which a given increase in local jobs will cause, and the Reno area poses some peculiar problems in translating job growth into population growth. One of these is the fact that, as a proportion of the population, the county's labor force is already quite large. The other is that rising housing prices can discourage inmigration and eventually act as a brake on economic growth. Each of these circumstances will be discussed in turn.

Labor Force-to-Population Ratios. The Reno area has a high percentage (72.0) of the working age population in the labor force. It also has a high percentage of labor force members per household. Table A-16 compares Reno SMSA and national data.

Table A-16

LABOR FORCE MEMBERS PER HOUSEHOLD:
RENO SMSA AND UNITED STATES

	Reno SMSA	United States
1970	1.38	1.26
1975	1.42	1.29
1977	NA	1.31

Source: U.S. Census of Population, 1970; U.S. Census, *Current Population Reports*, Population Characteristics, Sept. 1977; *Monthly Labor Review*, June 1979 and Aug. 1975.

That Reno diverges from the national norm in this manner is to be expected: areas experiencing rapid growth due to expanding employment tend to have that growth concentrated in

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the labor-force-age segment of the age spectrum. There would also be a higher than average incidence of households of individuals or of two or more unrelated individuals, all of whom are in the labor force. It is these nonfamily households that would tend to result in a high number of labor force members per household.

The SPC forecast to 1990 shows a decline in this indicator after 1980 (1980, 1.44 labor force members/household; 1985, 1.41; 1990, 1.39) implying a stabilizing or "maturing" of the economy. If the labor force members per household factor were to be sustained at its 1980 level, the number of future households (and needed housing units) would be lower than what is forecast by SPC. Since this indicator - labor force members per household - is critical in forecasting residential development, it would be beneficial for the present study to explore more closely the information and assumptions behind SPC's labor force/household relationship.

"Effective Demand" for Housing. The continuing divergence between the rate of increase of personal income and that of housing costs may have a marked effect on the attainment of the SPC forecasts. GG+A's research into housing development costs and housing prices - present and projected - indicate that costs and prices will continue to rise throughout the region.

Moreover, analysis of income trends finds that, in general, personal and household income gains will not keep pace with housing inflation.

This gap between what housing costs and what consumers can afford constitutes a second research area which could be further investigated. Economists distinguish between the simple need for housing and the income levels which can support rental or mortgage payments. It is the latter which is called "effective demand".

Because short-run housing prices are anticipated to be lower outside Washoe County than inside, the effective demand problem contributes to population dispersion, though it is not possible based on current research to estimate how these households would be distributed among the neighboring counties, or indeed to be certain that they will move to the region at all if they have prior information about housing cost and availability. More research is needed to firm up preliminary estimates of spillover and to adjust regional population forecasts to account for this redistribution.

Short-run Supply of Spillover Housing Potentially Adequate: Long-run Supply Doubtful. GG+A's research into development projections in the outlying counties found that the short-run supply of new housing units will exceed the requirements of the locally-based labor force. The "excess" would presumably serve Reno/Sparks incommuters. Some developers are definitely playing to this market in the short run.

Information on developers' plans is generally limited to the near future and is subject to change as developers react to changing market conditions by adjusting the programming of development. Furthermore, no claim is made that developer contacts were exhaustive. However, research was of sufficient depth and extent to confirm that substantial housing construction relating to Reno-area growth can be expected outside Washoe County in the coming five to ten years. Where infrastructure constraints exist, developers (in cooperation with public agencies) appear to recognize the problems, and short-run solutions seem likely to be found, permitting significant amounts of new development to proceed (particularly in Lyon and Douglas Counties).

Data to be presented in Chapter 4 suggest a shortfall of as many as 12,000 to 16,000 housing units in Truckee Meadows by 1990. This housing constraint would result in spillover to some degree. Based upon a review of development plans and conditions in the west central Nevada region outside Truckee Meadows, it appears likely that the bulk of the spillover demand can be accommodated. Examples of potential growth areas which can provide housing to Reno/Sparks job-holders include Fernley, where some 5,000 units are projected to be added to the existing housing stock by 1990, beginning as soon as a resolution of the water supply problem is agreed upon; and Fallon, which can accommodate another 1,000 units within its current wastewater treatment capacity. The Minden-Gardnerville area can accommodate an additional 1,900 sewer hook-ups, and some of the new housing to be developed there is expected to be multi-family rental units, which will continue to be in short supply in Washoe County. The central Lyon County area, from Dayton east to Silver Springs, will experience additional development. All the neighboring Nevada counties have some capacity for large-lot rural development. And development across the state line in neighboring California counties (Lassen, Sierra, Nevada, Placer and El Dorado) would be available to some degree, though it has not been documented in this study.

However, as the 1980's draw to an end, growth constraints will increasingly hamper development in these outlying areas unless major obstacles to substantial growth are eliminated, and it is not possible to affirm that that will happen. With outlying counties less able to take up the slack, Truckee Meadows' housing problem may well result in diminished inmigration and serve to inhibit further economic and population growth.

Provisional Population Estimates for Environmental Assessment

County Forecasts by State Planning Coordinator

The initial evaluation of environmental impacts of the Reno/Sparks Joint Wastewater Facilities Plan will be based on the State Planning Coordinator's future population estimates by county, as presented in Table A-17. These are the State of Nevada's official forecasts both for the state as a whole and for its counties, and as such are an appropriate departure point for population estimation.

Table A-17

POPULATION FORECASTS FOR WEST CENTRAL NEVADA REGION

	1975		1980	1985	1990	2000
Washoe County	145,000	SPC	217,000	277,700	337,900	468,300
		[SPPCo	194,800	268,300	343,400]	--
Carson City	25,300	SPC	38,300	55,100	73,500	104,500
		[SPPCo	31,700	39,500	49,900]	--
Douglas County Carson Valley Portion (60% of County)	6,660	SPC	9,600	11,800	12,700	17,220
		[SPPCo	9,700	14,000	18,300]	--
Churchill County	12,000		13,560	14,870	16,060	18,730
Lyon County	10,500		8,000	8,055	8,570	9,090
Storey County	1,000		1,275	1,480	1,620	2,050
Regional Total	200,460		287,735	369,005	450,350	619,890
Percent of State	34%		38%	38%	38%	39%

Source: State Planning Coordinator, Memorandum of October 10, 1978; Sierra Pacific Power Company.

For Washoe County, the SPC forecast shows 337,900 people by 1990 and 468,300 by the year 2000. These totals imply a Truckee Meadows population of 270,300 in 1990 and 374,640 by the year 2000. The latter figure represents more than a 2-1/3 increase over the 1979 estimate of 157,350 (80 percent of the SPC estimate of 196,700 for Washoe County). The forecast approaches the estimated holding capacity of the region, which is 376,900 for the four water service areas in Truckee Meadows (Sierra Pacific, Hidden Valley, Sun Valley and Panther Valley; see Table A-41, p. A-80).

Downward Adjustment of Forecast to be Considered

The SPC's year 2000 forecast seems likely to err on the high side. It continues into the 1990's the rapid growth rates anticipated in the 1980's, themselves an extension of the current boom. It would be very unusual for a fast-growth period to continue throughout two decades. Furthermore, a number of issues raised in this chapter - resource constraints and housing cost/availability - suggest that practical difficulties will increasingly constrain future growth.

Further research is needed to determine the likely extent to which SPC's year 2000 forecast overestimates the future growth of the region. Water supply will be the first potential constraint to be explored in the EIS research program. Should it be found that there would be adequate potable water to serve a population capacity of 470,000 in Washoe County, then it would be advisable to look more closely at the two socioeconomic constraints discussed in this chapter: the ability of the population to sustain a high labor force participation rate (a requirement which would seem mandated by the low earnings character of much of the region's employment) and the availability/affordability of housing in the region. But further investigation of these potential demographic and economic constraints will be deferred until the water supply issue is addressed.

A Provisional Range Estimate of the County's Future Population

The SPC forecast represents the high end of the range of future population growth, and that forecast may be revised downward based on the findings of the kinds of resource and socioeconomic investigations just described.

Provisionally, a lower limit to the range of future population growth can be established via a reduction in the SPC forecast based upon the shortfall of available housing estimated in Chapter 4. Table A-18 presents the resulting population range.

Table A-18

RANGE ESTIMATE OF TRUCKEE MEADOWS' FUTURE POPULATION

	High End (Based on SPC Forecasts)		Low End (SPC Forecasts Less Housing Shortfall)	
	1990	2000	1990	2000
Washoe County	337,900	468,300	Not estimated	
Truckee Meadows[1]	270,300	374,640	236,600[2]	306,000[2]

[1] Truckee Meadows in this analysis includes Reno, Sparks, surrounding unincorporated areas (defined by RPC) and Reno-Stead.

[2] Assumes that 12,000 households in 1990 and 24,500 in 2000 potentially attracted to Truckee Meadows by new jobs (Table A-25) will settle elsewhere or not come to the region at all due to shortfall of affordable housing. Uses factors of 2.81 persons per household in 1990 and 2.79 in 2000 as discussed in Chapter 4 (Table A-19).

Source: Gruen Gruen + Associates

CHAPTER 4

HOUSING RENO'S FUTURE GROWTH

The previous chapters of this appendix have discussed the economic and population growth expected to occur in the Reno SMSA during the next two decades. Based on the forecast by the State Planning Coordinator's Office, they estimate that by 1990 there will be 197,100 jobs and 337,900 people in Washoe County, and that by the year 2000 population will have grown to 468,300 (there is no employment forecast for the year 2000).

To accommodate these increases in employment and population, new plants, offices and homes must be built. The subject of this chapter is an estimate of the future demand for new housing and of the number of households that, unable to find the dwelling units they desire or can afford in Truckee Meadows, will seek units elsewhere (or not move to the region).

In order to distinguish the households that will stay in Truckee Meadows from those that will look elsewhere, it is first necessary to distinguish between total housing demand and effective housing demand. Total demand is the sum of all households' demands for dwelling units. It may be thought of as roughly equivalent to the number of new households plus replacements for dilapidated, burned or otherwise lost units and some extra units to maintain a reasonable vacancy factor. Effective demand is more limited; it includes the demands of only those households that can afford to pay the going prices for the types of housing they desire. For example, a household with an annual income of $5,000 would probably not be able to purchase a single-family house and therefore would not be included in the effective demand for that type of unit.

The total and effective demand for housing will depend on the number of new households in the Reno area, their incomes, the types of tenure and structure arrangements they desire and the prices of various housing types. These factors are considered in the following pages.

Demand for Housing

Number of New Households in Washoe County

A household is any group of people that shares a dwelling unit; in fact, the number of households in an area is identical to the number of occupied dwellings. The people sharing the unit may be a family, two families, unrelated individuals, one individual alone or any other group.

In 1970, Washoe County had 121,068 residents living in 41,762 households, for an average of 2.90 people per household. By 1975, the population had grown to an estimated 145,000 residents living in 49,421 households, for an average household size of 2.93 people. This increase is not expected to continue in the future, and it is anticipated instead that household sizes will gradually decline, consistent with national trends. Estimated household sizes and numbers of households for future years are presented in Table A-19.

The table indicates that about 118,430 new households are expected in Washoe County between 1975 and the end of this century. These households will be comprised of both persons moving into Washoe County and persons who already live in the county moving out of other households (e.g., young people leaving their parents' homes).

Table A-19

HOUSEHOLD SIZES AND NUMBERS OF HOUSEHOLDS IN WASHOE COUNTY

Year	Population	Average Household Size	Number of Households
1970	121,068	2.90	41,760
1975	145,000	2.93	49,420
1980	217,000	2.89	75,080
1985	277,742	2.83	98,170
1990	337,900	2.81	120,290
2000	468,300	2.79	167,850

Potential households added, 1975 to 2000: 167,850 less 49,420 = 118,430.

Source: State Planning Coordinator's Office. Household size and number of households in the year 2000 estimated by Gruen Gruen + Associates.

Total Housing Demand

The demand for housing may be defined not only as a gross number of dwelling units - 118,430, for example - but also in terms of preferred tenure (owner-occupant or renter-occupant), preferred structure type (single-family, multiple family or mobile home) and price range. While the housing preferences of future households are difficult to anticipate, some clues as to the patterns they will form are offered by information about current households' preferences. A forecast based on such information assumes that the demand characteristics of new households will be similar to those of current households; in other words, that new households will move to Reno in search of the same kinds of living arrangements sought by previous movers-in.

The methodology for estimating the future tenure and structure mix, based on data from the U.S. Census of 1970, is presented in detail in Subappendix A4. In general, the procedure begins with a redistribution of households among the defined income categories to account for real income growth. (Real income growth is the amount by which measured gains in income exceed inflation.) Tenure and structure type mix is then defined for each income group, and the expected households are finally assigned proportionately to income-tenure-structure type categories.

In general, forecasts of housing demand for a region consider future demand from both current households and new households. Demand from current households results when households move up the income scale; as their real income gains move them into higher income categories, they are assumed to purchase or rent new housing units and leave their old units to "filter down" through the groups that cannot afford new dwellings.

In this Reno area forecast, however, it is assumed that there will be no real income growth between 1975 and the year 2000. This assumption is based upon conclusions drawn from recent trends in housing prices and the economy as a whole, and the inability of service sector wages in Washoe County to keep up with inflation during the 1970's. Because no growth in real income is forecast, current households are not expected to move into higher income brackets and consequently are not expected to demand new housing units.* Therefore, the forecast of housing demand addresses only demand by new households.

The distribution of new Washoe County households among income-tenure-structure type categories is presented in Table A-20.

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*This assumption anticipates that there will be some trading of housing units among current households. It also allows for the case in which current households may have real income gains but new households with lower incomes move into their old units.

Table A-20

ANTICIPATED TENURE AND STRUCTURE TYPE DEMANDS OF NEW HOUSEHOLDS IN WASHOE COUNTY BY INCOME GROUP (Percent of All New Households)

	Owner-Occupants			Renter-Occupants			
Income (1978 Dollars)	Single-Family	Multi-Family	Mobile Home	Single-Family	Multi-Family	Mobile Home	Total
Less than $9,799	6	0	3	4	10	0	23
$9,800 - $19,574	9	1	3	5	10	0	28
$19,575 - $29,374	14	1	2	4	4	0	25
$29,375 - $48,949	12	0	1	2	2	0	17
$48,950 or more	6	0	0	.5	.5	0	7
TOTAL	47	2	9	15.5	26.5	0	100

Source: Gruen Gruen + Associates

It is reasonable to assume that this pattern of demand will be exhibited during each period of the population forecast; e.g., new households during 1975-80, 1980-85, 1985-90 and 1990-2000 will have similarly distributed incomes (in 1978 dollars) and similarly distributed tenure and structure types. The number of households in each income group seeking each type of housing in the county between 1975 and the year 2000 is estimated in Table A-21.

Total Housing Demand in Truckee Meadows. It is also reasonable to expect that about 80% (94,744) of the new households in Washoe County - the historic share - will seek dwelling units in Truckee Meadows and that all of the new households preferring to rent units in multi-family structures (31,385) will want to live in the Meadows. The remaining 63,359 households desiring units in Truckee Meadows will either want to own those units, to rent single family homes or to live in their (owned) mobile homes. These remaining households are assumed to be proportionately distributed among the appropriate income, tenure and structure categories.*

The resulting estimate of total demand for housing in Truckee Meadows between 1975 and the year 2000 is presented in Table A-22 and summarized in Table A-23.

*These assumptions have the result of allocating a slightly greater proportion of households in the lower income groups to Truckee Meadows than is found in the county as a whole. This allocation more closely resembles the distribution of Truckee Meadows households among income groups evident in the 1970 Census than a county-based distribution would. As it is very unlikely that multi-family rental units would be constructed outside the cities, this approach is a sensible one.

Table A-21

ESTIMATED HOUSING DEMAND IN WASHOE COUNTY BY INCOME, TENURE AND TYPE OF STRUCTURE, 1975-2000

	Owner-Occupants			Renter-Occupants			
1975-80 Income (1978 $)	Single-Family	Multi-Family	Mobile Home	Single-Family	Multi-Family	Mobile Home	Total
Less than $9,799	1,540	0	770	1,026	2,566	0	5,902
$9,800 - $19,574	2,309	257	770	1,283	2,566	0	7,185
$19,575 - $29,374	3,592	257	514	1,026	1,026	0	6,415
$29,375 - $48,949	3,079	0	257	513	513	0	4,362
$48,950 or more	1,540	0	0	128	128	0	1,796
TOTAL	12,060	514	2,311	3,976	6,799	0	25,660
1980-85 Income (1978 $)							
Less than $9,799	1,385	0	693	923	2,309	0	5,310
$9,800 - $19,574	2,078	231	693	1,154	2,309	0	6,465
$19,575 - $29,374	3,232	231	462	923	923	0	5,771
$29,375 - $48,949	2,770	0	231	462	462	0	3,925
$48,950 or more	1,385	0	0	115	115	0	1,615
TOTAL	10,850	462	2,079	3,577	6,118	0	23,087
1985-90 Income (1978 $)							
Less than $9,799	1,327	0	664	885	2,212	0	5,088
$9,800 - $19,574	1,991	221	664	1,106	2,212	0	6,194
$19,575 - $29,374	3,096	221	442	885	885	0	5,529
$29,375 - $48,949	2,654	0	221	442	442	0	3,759
$48,950 or more	1,327	0	0	111	111	0	1,549
TOTAL	10,395	442	1,991	3,429	5,862	0	22,117
1990-2000 Income (1978 $)							
Less than $9,799	2,854	0	1,427	1,903	4,757	0	10,941
$9,800 - $19,574	4,281	476	1,427	2,378	4,757	0	13,319
$19,575 - $29,374	6,659	476	951	1,903	1,903	0	11,892
$29,375 - $48,949	5,708	0	476	951	951	0	8,086
$48,950 or more	2,854	0	0	238	238	0	3,330
TOTAL	22,356	952	4,281	7,373	12,606	0	47,565

N.B. Detail may not add to grand totals because of rounding.

Source: Gruen Gruen + Associates

Table A-22

ESTIMATED HOUSING DEMAND IN TRUCKEE MEADOWS BY INCOME, TENURE AND TYPE OF STRUCTURE, 1975-2000

	Owner-Occupant			Renter-Occupant			
1975-80 Income (1978 $)	Single-Family	Multi-Family	Mobile Home	Single-Family	Multi-Family	Mobile Home	Total
Less than $9,799	1,121	0	560	747	2,566	0	4,994
$9,800 - $19,574	1,681	187	560	934	2,566	0	5,928
$19,575 - $29,374	2,615	187	374	747	1,026	0	4,949
$29,375 - $48,949	2,241	0	187	374	513	0	3,315
$48,950 or more	1,121	0	0	93	128	0	1,342
TOTAL	8,779	374	1,681	2,895	6,799	0	20,528
1980-85 Income (1978 $)							
Less than $9,799	1,008	0	504	672	2,309	0	4,493
$9,800 - $19,574	1,513	168	504	840	2,309	0	5,334
$19,575 - $29,374	2,353	168	336	672	923	0	4,452
$29,375 - $48,949	2,016	0	168	336	462	0	2,982
$48,950 or more	1,008	0	0	84	115	0	1,207
TOTAL	7,898	336	1,512	2,604	6,118	0	18,470
1985-90 Income (1978 $)							
Less than $9,799	966	0	483	644	2,212	0	4,305
$9,800 - $19,574	1,449	161	483	805	2,212	0	5,110
$19,575 - $29,374	2,253	161	322	644	885	0	4,265
$29,375 - $48,949	1,932	0	161	322	442	0	2,857
$48,950 or more	966	0	0	81	111	0	1,158
TOTAL	7,566	322	1,449	2,496	5,862	0	17,694
1990-2000 Income (1978 $)							
Less than $9,799	2,077	0	1,039	1,385	4,757	0	9,258
$9,800 - $19,574	3,116	346	1,039	1,731	4,757	0	10,989
$19,575 - $29,374	4,847	346	692	1,385	1,903	0	9,173
$29,375 - $48,949	4,154	0	346	692	951	0	6,143
$48,950 or more	2,077	0	0	173	238	0	2,488
TOTAL	16,271	692	3,116	5,366	12,606	0	38,052

N.B. Detail may not add to grand totals because of rounding.

Source: Gruen Gruen + Associates

Table A-23

SUMMARY OF ESTIMATED TOTAL HOUSING DEMAND IN TRUCKEE MEADOWS, 1975-2000

Year	Type of Structure Single-Family	Multi-Family	Mobile Home	Total
1975-80	11,674	7,173	1,681	20,528
1980-85	10,502	6,454	1,512	18,470
1985-90	10,062	6,184	1,449	17,694
1990-2000	21,637	13,298	3,116	38,052
TOTAL	53,875	33,109	7,758	94,744

N.B. Detail may not add to totals because of rounding.

Source: Gruen Gruen + Associates

These estimates of total demand for single-family and multi-family dwelling units and mobile homes may be considered the upper limit of actual housing demand in Truckee Meadows during the study period. They would be achieved if economic growth continues at the rates forecast, if the expected numerical relationships between employment and population and between population and households occur, and if all households are able to find units they can afford in Truckee Meadows.

Effective Demand for Housing. The distribution of total housing demand presented in Table A-22 and summarized in Table A-23 indicates the types of housing mix Reno area households would desire if they both (1) conformed to the 1970 housing type and tenure distribution and the adjustments made to translate countywide demand to Truckee Meadows demand and (2) could afford to purchase or rent the types of units they most desire.

In reality, some households in the lower income groups will not be able to pay the price of a new house, condominium or apartment. Some of these households will be able to purchase or rent "used" units; others will either settle for a second or third choice living arrangement in the Reno area or look for their preferred dwelling types in outlying areas, in the hope that prices will be lower there, and commute to jobs in Reno-Sparks.

Which households will be able to find the dwellings they seek in the Reno area? In the spring of 1979, the lowest priced new single-family homes were priced at about $60,000, and prices in the $70,000 to $75,000 range were more common. Buyers for $60,000 homes must have incomes of at least $20,000 per year. Given this criterion, about 47% of Reno area households (those in the three higher income categories) could afford to purchase new homes, and about 29% would desire to do so. About 6% of area households would be in the single-family rental market, and they could also probably find units they desire.

New multi-family ownership units - condominiums or townhouses - were available in the Reno area for a minimum of $40,000 in spring of 1979, with $50,000 price tags more common. These units would be affordable to households with incomes of at least $12,000 to $13,000, or approximately 66% of Reno households (the three higher income groups plus about two-thirds of the $9,800 to $19,574 group). Only an estimated two percent of the households are expected to demand this type of housing as a first choice, but it is likely that additional households - those who prefer but cannot afford single-family units - will also enter this market, bringing the total demand for ownership units in multi-family structures to about seven percent of all households.

Households demanding new rental units in multi-family structures in spring of 1979 required incomes of at least $900 per month, or nearly $11,000 per year. Assuming that households in the $9,800 to $19,574 income group are spread evenly through that group, about 75% of the households in that group could afford new rental units. Therefore, of the 33% of Reno area households potentially in the multi-family rental market, about half (18% of all households) would be able to afford new units. In addition, some of the households who prefer to rent single-family homes will likely settle for multi-family units, bringing the total demand for new multi-family renter-occupied units to about 21% of all households.

About nine percent of area households would prefer to live in their own (owned) mobile homes. Rentals for mobile home spaces have historically been lower than for houses or apartments, but to the price of the space must be added the price of the mobile home for at least the first several years.

Assuming, for example, that a $10,000 mobile home could be purchased with 20% down and a three-year loan at 10% interest for the balance, the monthly payment required for the loan would be $258. Assuming further that a loan could be obtained by a household with a monthly income of four times the payment amount, the household would need a monthly income of $1,032, equivalent to an annual income of almost $12,400. About four percent of Reno area households could effectively demand mobile home housing at this price.

Table A-24 summarizes the foregoing estimates of effective demand for housing by tenure and structure type.

Table A-24

ESTIMATED EFFECTIVE AND UNMET DEMAND FOR HOUSING IN TRUCKEE MEADOWS
(% of All New Households)

	Single-family		Multiple-family		Mobile Home (Own)	Total
	Own	Rent	Own	Rent		
Effective Demand	29	6	7[1]	21[2]	4	67
Unmet Demand	8	5	0	15	5	33
TOTAL	37	11	7[1]	36[2]	9	100

[1] Includes five percent who would purchase single-family homes if able to afford them.

[2] Includes four percent who would prefer to rent single-family homes.

Source: Gruen Gruen + Associates

The estimated effective demand may be translated into numbers of units in each period as shown in Table A-25.

Table A-25

ESTIMATED EFFECTIVE AND UNMET DEMAND FOR HOUSING IN TRUCKEE MEADOWS, 1975-2000
(Numbers of Units)

	Single-family		Multiple-family		Mobile Home (Own)	Total
Year	Own	Rent	Own	Rent		
			Effective Demand			
1975-80	5,953	1,232	1,437	4,311	821	13,754
1980-85	5,356	1,108	1,293	3,879	739	12,375
1985-90	5,131	1,062	1,239	3,716	708	11,856
1990-2000	11,035	2,283	2,664	7,991	1,522	25,495
TOTAL	27,475	5,685	6,633	19,897	3,790	63,479
			Unmet Demand			
1975-80	1,642	1,026	0	3,079	1,026	6,773
1980-85	1,478	924	0	2,771	924	6,097
1985-90	1,416	885	0	2,654	885	5,840
1990-2000	3,044	1,903	0	5,708	1,903	12,558
TOTAL	7,580	4,738	0	14,212	4,738	31,268

N.B. Detail may not add to totals because of rounding.

Source: Gruen Gruen + Associates

Supply of Housing

Recent Supply Characteristics

As noted in Chapter 2 (page A-34), residential construction in the Reno SMSA between 1970 and 1978 averaged almost 3,300 dwelling units per year. Of the 3,800, about 2,900 (77%) were built in the cities of Reno and Sparks. Construction of single-family units (including units in planned unit developments and condominiums) averaged 1,820 per year (48%) in the county and 1,140 (39%) in Reno and Sparks. These characteristics are summarized in Table A-26.

Table A-26

STRUCTURE TYPES OF DWELLING UNITS
IN WASHOE COUNTY, 1970-1978

	Single-Family*	Multi-Family	Total
Reno			
Total	6,387	11,711	18,098
Annual Average	710	1,301	2,011
Sparks			
Total	3,874	4,340	8,214
Annual Average	430	482	913
Rest of Washoe County			
Total	6,122	1,636	7,758
Annual Average	680	182	862
All of Washoe County			
Total	16,383	17,687	34,070
Annual Average	1,820	1,965	3,786

N.B. Detail may not add to total because of rounding.

*Includes units in planned unit developments and condominiums.

Source: U. S. Department of Commerce, Bureau of the Census, Housing Authorized by Building Permits and Public Contracts (Series C40); local building departments.

Anticipated Short-term Supply

Units Currently Planned. Interviews conducted with planning staff and major developers in Reno and Sparks during May 1979 indicated that a significant number of units will be constructed during the 1980's if constraints such as wastewater treatment capacity can be overcome. Units currently approved or under consideration by the public sector or firmly planned by the private sector total approximately 15,930, of which 9,041 (57%) would be built at densities of fewer than nine units to the acre and 9,262 (58%) would be built inside the current boundaries of Reno and Sparks. The structure types and locations of these units are summarized in Table A-27.

Table A-27

STRUCTURE TYPES AND LOCATIONS OF
PLANNED DWELLING UNITS IN TRUCKEE MEADOWS

	Single-Family	Multi-Family	Total
Reno	3,013	2,093	5,106
Sparks	1,561	2,595	4,156
Other	3,717	2,953	6,670
TOTAL	8,291	7,641	15,932

Source: Gruen Gruen + Associates

Other Units Expected to be Built in Truckee Meadows. The supply of dwelling units currently planned, as described above, is expected to be supplemented by the development of several large parcels of land in Truckee Meadows during the 1980's. These parcels include the Double Diamond, Damonte, Bella Vista, Jones and D'Andrea Ranches plus some lands northwest of the City of Reno. Because these areas have not yet entered the development process, estimates of the number of units they may hold should be considered maximums and timing for their completion (that is, before 1990) should be considered optimistic. The number of units expected to become available upon development of these areas is detailed in Table A-28.

Summary of Anticipated Short-term Supply. The combination of currently planned units, as shown in Table A-27, and other expected development, estimated in Table A-28, comprises the documented short-term housing supply for the Reno-Sparks area. (The total short-term supply may be slightly larger, including units planned by developers not interviewed or mentioned during the research effort.) This combination would provide an estimated 22,935 to 26,965 dwelling units in Truckee Meadows during the 1980's, as shown in Table A-29.

Table A-28

STRUCTURE TYPES AND LOCATIONS OF EXPECTED DWELLING UNITS NOT YET IN THE DEVELOPMENT PROCESS*

Location	Single-Family	Multi-Family	Total
Northwest of Reno	3,016	300	3,316
Damonte Ranch	628-838		628-838
Double Diamond Ranch	342-455		342-455
Bella Vista Ranch	575-766	45-60	620-826
Jones Ranch	600		600
D'Andrea Ranch	1,500		1,500
Reno-Stead	0-3,500	345-360	0-3,500
TOTAL	6,660-10,675		7,005-11,035

*As of May 1979.

Source: Regional Planning Commission; City of Sparks.

Table A-29

ESTIMATE OF TOTAL SHORT-TERM SUPPLY OF DWELLING UNITS IN TRUCKEE MEADOWS

	Single-Family	Multi-Family	Total
Reno*	3,013-6,513	2,093	5,106-8,606
Sparks	1,561	2,595	4,156
Other	10,378-10,892	3,298-3,313	13,676-14,205
TOTAL	14,950-18,965	7,985-8,000	22,935-26,965

*Includes Stead.

Source: Gruen Gruen + Associates

Anticipated Long-term Supply

A long-term projection of housing supply cannot be developed in the same manner as is a short-term projection, because developers do not plan their projects far enough in advance to know now what their construction activity will be after 1990. A possible alternative indicator of the housing market's potential ability to meet demand, however, is the projected holding capacity of the Meadows as estimated by the Regional Planning Commission in the Land Use Plan for Truckee Meadows. Those estimates may be considered the maximum possible supply of housing by the year 2000.

The holding capacities for Reno and Sparks may be calculated from data in the Truckee Meadows Wastewater Management Study, a preliminary draft of which was published in August 1978. That draft also contained estimates of the number of units in each area as of 1976. The 1976 and holding capacity figures are presented in Table A-30, along with the implied remaining capacity in each area as of 1976.

Table A-30

EXISTING (1976) DWELLING UNITS AND ULTIMATE DWELLING UNIT CAPACITY IN TRUCKEE MEADOWS

	Existing (1976)	Year 2000 Capacity	Remaining Capacity
Reno	36,321	71,996	35,675
Sparks	12,898	23,451	10,553
Other	14,728	62,605	47,877
TOTAL	63,950	158,050	94,105

N.B. Detail may not add to total because of rounding.

Source: URS Company, Truckee Meadows Wastewater Management Study (Washoe Council of Governments, Washoe County, Nevada; 208 Areawide Wastewater Management Program), p. 18.

The figures in Table A-30 indicate that there is a significant amount of room for new dwelling units in Truckee Meadows. Even if future development achieves only 75% of holding capacity (75% is a figure used by RPC for estimating purposes), the RPC estimate suggests that a long-term supply of nearly 70,600 new dwelling units in the Meadows is physically possible.

Comparison of Anticipated Housing Demand and Supply

The foregoing estimates of housing supply and demand may be compared to project the net surplus or shortfall of new dwelling units in Truckee Meadows during the study period. This comparison may be made for both the short term (through 1990) and the long term (through the year 2000).

Short-term Supply and Demand

The estimate of effective demand presented in Table A-24 suggests that a total of about 38,200 new households will be able to afford new housing in Truckee Meadows between 1975 and 1990, including 35,900 conventional dwelling units. To satisfy that demand, residential construction would have to continue at a rate of 2,400 units per year, about two-thirds the 1970-78 average of 3,786 units per year.

The anticipated short-term supply documented in Table A-29, which documents constructions in Truckee Meadows averaging between 2,200 and 2,575 units per year over the 11-year period, would therefore satisfy effective demand during the period.

For comparison, two estimates of short-term supply and demand are presented in Table A-31. The two estimates of supply are the documented supply, as estimated in Table A-29, and supply at the historic rate (80% of total Washoe County supply between 1970 and 1978 inclusive).

Table A-31 indicates that the documented supply plus units for which permits were issued in 1976-78 would approximately meet the estimated effective demand, providing surpluses of both single- and multi-family units if all expected units are built. (A shift to conventional units by households assumed to demand mobile homes could neutralize these surpluses.) Supply at the historic rate would provide substantial surpluses, and therefore cannot be considered likely.

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Table A-31

EFFECTIVE HOUSING DEMAND, DOCUMENTED HOUSING SUPPLY AND REQUIRED HOUSING SUPPLY FOR TRUCKEE MEADOWS, 1975-1990

	Single-family	Multi-family	Mobile Home	Total
Effective Demand	19,900	15,900	2,300	38,000
Permitted 1976-78[1]	6,750	8,700	n.a.	15,450
Documented Supply	15,000-19,000	8,000	-	23,000-27,000
Surplus (+) or Shortfall (-)	+1,850 to +5,850	+ 800	-2,300	+350 to +4,450
Supply at Historic Rate[2]	16,000	17,300	n.a.	33,300
Surplus (+) or Shortfall (-)	+2,850 to +6,850	+10,100	n.a.	+12,950 to 16,950[3]

Note: Detail may not add to total because of rounding.
n.a.= not available.

[1] Includes 80% of single-family permits in Washoe County and its cities and all multi-family permits issued in Reno and Sparks.

[2] Includes 80% of all building permits issued by Washoe County and its cities at the 1970-78 annual rate of 3,786 permits for 11 years (1979-90).

[3] Plus mobile home shortfall or surplus.

Source: Gruen Gruen + Associates

Regardless of the available surplus in relation to *effective* demand, it is expected that approximately 18,700 households that will not be able to afford market prices for housing in the Reno-Sparks area and that their demands will therefore not be met.

Long-term Supply and Demand

Table A-25 indicates that about 60,700 households will seek to live in various types of dwelling units in Truckee Meadows between 1976 and the end of this century. The *Land Use Plan* for Truckee Meadows, as summarized in Table A-30, indicates that in 1976 there was room remaining for about 94,100 dwelling units in Truckee Meadows (if 100% of capacity were to be developed), of which about 46,230 could be built in the Reno and Sparks planning areas. This comparison, presented in Table A-32, suggests that sufficient developable land is available to accommodate a supply of housing adequate to meet year 2000 effective demand in Truckee Meadows, depending on how well the supply provided meets the income, tenure and structure type mix desired by new residents. The average pace of residential construction would be able to slacken somewhat from its 1970-78 rate, to an average of about 2,550 units annually, and still accommodate the effective demand. Unless there are constraints on developability not recognized in the land use plan (for example, deliberate efforts by landowners to keep vacant land undeveloped), the land supply seems sufficient to forestall radical increases in land prices.

Table A-32

LONG-TERM HOUSING DEMAND
AND POTENTIAL SUPPLY IN TRUCKEE MEADOWS

	Number of Units
Effective Demand (1976-2000)*	60,700
Capacity (1976-2000)	94,100
Potentially Unused Capacity	33,400

NOTE: If units were built at the historic rate, there would be 90,864 dwellings provided between 1976 and 2000.

*Includes 80% of effective demand in 1976-80 and total effective demand in 1980-2000.

Source: Tables A-24 and A-30

The estimated unmet demand for housing in Truckee Meadows is expected to equal approximately 29,900 units between 1976 and the year 2000. While Table A-32 suggests that there would be ample room for this number of units in the Meadows, it is unlikely that they will be provided without governmental assistance. Some of these households may seek less expensive housing in the neighboring counties. But the fact that the number of households in this category is so large indicates that a major housing assistance effort would be required - or that population growth will not take place at SPC-forecast rates.

Geographic Distribution of New Dwelling Units

Location of Short-term Supply

The new dwelling units provided in Truckee Meadows through the year 1990 will be located primarily in the Sierra Pacific

Power Company's water service area. Of the 15,932 units currently planned and documented in Table A-26, about 15,200 are within the SPPCo service area, with the remainder in Spanish Springs and other areas of Truckee Meadows.

Of the 15,200 units within the SPPCo area, about 6,900 are expected to be built in the City of Reno (including Stead) and about 4,160 within the City of Sparks. Most of the remaining units are planned for the area just northwest of Reno; it is not unlikely that that area will be annexed to the city as development occurs. The locations of planned units are presented in Table A-33.

Table A-33

LOCATIONS OF DWELLING UNITS PLANNED
FOR TRUCKEE MEADOWS, 1979-1990

	Single-Family	Multi-Family	Total
Total	8,291	7,641	15,932
SPPCo water service area	7,525	7,641	15,166
City of Reno	*2,413*	*2,093*	*4,506*
City of Sparks	*1,561*	*2,595*	*4,156*
Northwest of Reno	*2,951*	*2,953*	*5,904*
Stead	*600*	*--*	*600*

Source: Gruen Gruen + Associates, based on interviews with RPC and local developers.

The dwelling units not yet in the development process but expected during the coming decade are located primarily east and southeast of the Reno-Sparks urban area, with some additional units anticipated northwest of Reno and some east of Sparks. These units are assigned to specific areas in Table A-28, and are grouped geographically in Table A-34.

Summary of Short-term Supply. These estimates of planned and expected units may be combined into an overall picture of the distribution of the short-term housing supply in Truckee Meadows. This distribution may be detailed by water service and sewer characteristics for future use in hydrologic and air quality forecasting. The combined detailed distribution is presented in Table A-35 (p. A-67).

Table A-34

LOCATIONS OF EXPECTED DWELLING UNITS NOT YET IN THE DEVELOPMENT PROCESS, 1979-1990

	Single-Family	Multi-Family	Total
Total	6,661-10,675	345-360	7,006-11,035
East of Reno-Sparks[1]	2,675-2,866	45-60	2,720-2,926
Southeast of Reno-Sparks[2]	970-1,293	0	970-1,293
Northwest of Reno	3,016	300	3,316
Reno-Stead	0-3,500	0	0-3,500

[1] Includes Jones Ranch, Bella Vista Ranch and D'Andrea Ranch. Jones and Bella Vista Ranches are partly within Hidden Valley Water District; D'Andrea Ranch is partly within SPPCo water district.

[2] Includes Double Diamond and Damonte Ranches. Neither is within a water service area.

Source: Gruen Gruen + Associates, based on interviews with RPC and City of Sparks.

The anticipated density of expected and planned single-family dwellings included in Table A-35 averages about 1.7 units per gross acre if the Damonte, Double Diamond and Bella Vista Ranches are included, and about 4.6 units per gross acre if they are excluded. Densities in individual developments range from less than one unit per acre in some areas which do not have water service to an estimated 5.8 units per acre in some of the developments expected in the area northwest of Reno and 8 units per acre in some planned unit developments. Information regarding density of development was available for only 9,800 units (8,000 if the ranches are excluded).

The density of development for multi-family dwellings is expected to range from 8.8 units per gross acre in some condominium projects to 43 units per gross acre in some apartment projects. The overall average, based on information for 7,250 units, is expected to be about 15 units per gross acre.

The remaining dwelling unit capacities of both the cities of Reno and Sparks and the two major water service areas after the forecast short-term housing supply (through 1990) has been built are estimated in Table A-36. To the extent that RPC

Table A-35

PLANNED AND EXPECTED DWELLING UNITS IN TRUCKEE MEADOWS BY AIR QUALITY AND HYDROLOGIC ANALYSIS AREA, 1979-1990

	Hydrologic Analysis Area			
Air Quality Analysis Area	SPPCo Water Area	Hidden Valley Water Area	Outside Water Service Area	Total
City of Reno	2,500 sf 2,000 mf	0	0	2,500 sf 2,000 mf
City of Sparks	1,500 sf 2,600 mf	0	0	1,500 sf 2,600 mf
Unincorporated, within year 2000 sewer service area	7,000 sf 3,250 mf	1,250-1,500 sf[1] 50 mf[1]	1000 sf[2]	9,250-9,500 sf 3,250-3,300 mf
Sun Valley	0	0	0	0
Steamboat Valley	0	0	750 sf[3]	750 sf
Truckee River portion of ultimate sewer area	0	0	250 sf	250 sf
Spanish Springs Valley	0	0	500 sf	500 sf
Lemmon Valley/Stead	500-4,100 sf	0	0	500-4,100 sf
Washoe Valley	0	0	0	0
TOTAL	11,500-15,100 sf 7,850 mf	1,250-1,500 sf 50 mf	2,500 sf	15,250-19,100 sf 7,850-7,900 mf

[1] Includes Jones and Bella Vista Ranches (both are partially within Hidden Valley).
[2] Includes Double Diamond Ranch and part of D'Andrea Ranch.
[3] Includes Damonte Ranch.

Source: Gruen Gruen + Associates, based on interviews with RPC, City of Sparks and local developers.

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Table A-36

LAND AREA CAPACITIES FOR ADDITIONAL DWELLING UNITS AND EXPECTED CONSTRUCTION IN HYDROLOGIC STUDY AREAS, 1979-90

	Capacity (1978 Plan)	Existing Construction 1976	Estimated Construction 1977-78*	Estimated Construction 1979-90	Remaining Unused Capacity, 1990
Water Service Area					
SPPCo	136,558	59,000	9,250	31,250	37,050
Hidden Valley	2,491	500	0	1,800	200
Outside water service area	18,553	4,500	1,000	2,750	10,300
TOTAL	157,602	64,000	10,500	35,800	47,550
Cities					
Reno	71,996	36,321	6,373	4,500	24,802
Sparks	23,451	12,898	1,634	4,100	4,819
Unincorporated Area	62,605	14,728	2,039	14,500- 18,400	27,438- 31,338

*Estimated based on the number of building permits issued in 1976-77. Assumes 80% of all permits in the county were issued for Truckee Meadows sites, and that the proportion of sites outside the cities of Reno and Sparks but within the SPPCo service area is similar to that evident in the documented supply.

N.B. Detail may not add to total because of rounding.

Source: Appendix A, Table A-41 and Gruen Gruen + Associates

holding capacity estimates are accurate, the post-1990 figures represent the maximum number of dwelling units that could be added between 1990 and 2000. It should be noted, however, that the City of Sparks considers the units planned for development by 1990 (4,156 units) to comprise the vast majority of its remaining capacity, with only scattered infill sites available for additional development. In that case, potential capacity in the City of Sparks and the Sierra Pacific water district would be lower by about 6,400 units.

Location of Long-term Supply

As indicated in Table A-30, the Truckee Meadows land use plan shows that most remaining capacity in Truckee Meadows (about 73%) lies outside the cities of Reno and Sparks, although there is enough capacity within the two cities to accommodate expected effective demand through the year 2000. Because of uncertainties regarding availability of water and urban infrastructure in the unincorporated areas of the Meadows, the location of residential development completed between 1990 and the year 2000 is uncertain. The forecast presented below is based on the proportional distribution of development expected during 1979-1990, with adjustments for cases in which development would completely absorb or exceed remaining land use capacity.

The effective demand estimate of 24,000 dwelling units - 13,250 single-family and 10,750 multi-family - was used as an indicator of the number of units that would be built in the Truckee Meadows area between 1990 and 2000. Table A-36a presents the geographic distribution of these units. It should be noted once again that the City of Sparks expects the approximately 4,100 units planned for 1979-1990 to absorb its remaining capacity; in that case, the units allocated to Sparks in Table A-37 would be reassigned to Reno.

Table A-36b shows the distribution of dwelling units expected between 1990 and 2000 among air quality and water service areas, and Table A-36c presents estimates of remaining dwelling unit capacities for Reno, Sparks and the unincorporated areas of Washoe County after 2000, based on the geographic distribution presented in the preceding tables.

Table A-36a

GEOGRAPHIC DISTRIBUTION OF RESIDENTIAL DEVELOPMENT, 1990-2000

Area	Dwelling Units Single-family	Multi-family	Total
Reno	2,150	2,750	4,900
Sparks	1,200	3,500	4,700
Unincorporated area within year 2000 sewer service area	7,500	4,500	12,000
Sun Valley	0	0	0
Steamboat Valley	500	0	500
Truckee River	250	0	250
Spanish Springs	0	0	0
Lemmon Valley/Stead	2,000	0	2,000
Washoe Valley	0	0	0
TOTAL	13,250	10,750	24,000

NOTE: Detail may not add to total because of rounding.

Source: Gruen Gruen + Associates

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Table A-36b

ANTICIPATED RESIDENTIAL CONSTRUCTION BY AIR QUALITY AND HYDROLOGY ANALYSIS AREAS, 1990-2000

	Hydrology Analysis Areas			
Air Quality Areas	SPPCo	Hidden Valley	Other	Total
Reno	2,150 sf 2,750 mf	0	0	2,150 sf 2,750 mf
Sparks	1,200 sf 3,500 mf	0	0	1,200 sf 3,500 mf
Unincorporated area within year 2000 sewer service area	6,500 sf 4,500 mf	350 sf 0 mf	500 sf 0 mf	7,500 sf 4,500 mf
Sun Valley	0	0	0	0
Steamboat Valley	0	0	500 sf 0 mf	500 sf 0 mf
Truckee River	0	0	250 sf 0 mf	250 sf 0 mf
Spanish Springs	0	0	0	0
Lemmon Valley/Stead	1,500 sf 0 mf	0	500 sf 0 mf	2,000 sf 0 mf
Washoe Valley	0	0	0	0
TOTAL	11,500 sf 10,750 mf	0	1,750 sf 0 mf	13,250 sf 10,750 mf

NOTE: Detail may not add to total because of rounding.

Source: Gruen Gruen + Associates

Table A-36c

REMAINING DWELLING UNIT CAPACITIES IN AIR QUALITY ANALYSIS AREAS AFTER 2000

Area	Post-1990 Capacity	Expected Development 1990-2000	Post-2000 Capacity
Reno	24,802	4,900	19,902
Sparks	4,819	4,700	119
Unincorporated area	27,438- 31,338	14,400	13,038- 16,938

NOTE: Detail may not add to total because of rounding.

Source: Gruen Gruen + Associates

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SUBAPPENDIX A1

POPULATION PROJECTION AND FORECASTING TECHNIQUES

Projection and Forecasting

In estimating the population of a given geographic or political unit at some future time, there are two major approaches available. The first is projection, which means the mathematical or other systematic extension into the future of observed statistical trends. The second is forecasting, which attempts to identify the underlying causes of population change and take those factors into account in predicting the direction of magnitude of future change.

Projection Techniques

Projection, in order to extend observed conditions or trends into the future, requires the application of historic data. The selection of data used as the basis of a projection and the selection of projection technique should be based on judgment as to which characteristics or trends of the past are most likely to influence future conditions. The use of a projection technique involves the assumption that the factors which created a certain pattern of population change in the past will continue to be present and to have the same effects in the future.

There are several major kinds of simple projection techniques. Arithmetic (or linear) projection assumes that population will grow by the same number of people every year. Geometric progression is growth at a constant rate. A third common projection method is the decreasing rate-of-increase, which is based upon an estimate of an area's ultimate holding capacity, with the annual growth rate declining over time until saturation is approached. A fourth technique, ratio-and-correlation, bases local area projections on those prepared for a larger geographic or political unit, typically assuming that local area population will remain a fixed proportion of the population in the larger area.

The choice of base years influences the outcome of a projection. Table A-37 presents Washoe County and state population data for various years.

In Table A-38 are presented a series of population projections for Washoe County based upon four different projection techniques, illustrating the fact that decisions relating to methodology and data can markedly affect the outcome of the prediction process. Therefore, the assumptions - implicit and explicit - of population prediction procedures must be evaluated.

Table A-37

WASHOE COUNTY AND STATE OF NEVADA HISTORIC POPULATION

Year	Washoe County	State of Nevada	County as % of State
1978	176,368	677,803	26.0
1977	156,058	633,397	24.6
1976	150,396	612,666	24.5
1975	145,000	590,300	24.6
1974	141,900	574,000	24.7
1973	136,730	551,925	24.8
1972	130,500	527,400	24.7
1971	126,200	510,200	24.7
1970	121,068	488,738	24.8
1965	103,420	386,466	26.8
1960	84,743	285,278	29.7
1950	50,205	160,083	31.4

Sources: 1960 and 1970 data from U. S. Census of Population; 1971-1977 are estimates by the Bureau of the Census as tabulated in Nevada State Planning Coordinator (SPC), 1978; 1978 provisional estimates and 1965 estimates from SPC (Tierney, pers. comm.); 1950 from County and City Data Book, 1956 (A Statistical Abstract Supplement), Bureau of the Census, 1957.

Forecasting Techniques

A forecast goes farther than a projection in incorporating into the prediction methodology known characteristics of the population and economy; in general, the forecaster applies judgment in determining the extent to which the future population pattern will reflect or diverge from the past. Forecasts may be based on demographic or economic data or a combination of the two.

Demographic data can provide the basis for prediction of future population. The key ingredient is the age/sex structure of the population. The 'cohort survival' technique considers the number of persons in each age group and adjusts that number by applying age-specific and sex-specific death rates to estimate the future population in that age cohort. The number of persons in the youngest age cohort is estimated from the number of women in child-bearing age cohorts and their age-specific fertility rates. The calculation of birth minus deaths results in the net natural increase of the population. This approach can be quite accurate for areas not experiencing significant in- and migration.

Table A-38

ILLUSTRATIONS OF POPULATION PROJECTIONS RESULTING FROM VARIOUS TECHNIQUES AND USE OF BASE DATA FROM VARIOUS YEARS

Method	Year(s) of Data Used in Projection	Population in Future Year 1985	Population in Future Year 2000	How Increase is Estimated
				Population Added Annually
Arithmetic	1960, 1970	195,500	249,900	3632.5 persons/year
	1970, 1978	224,800	328,400	6912.5 persons/year
	1960, 1978	212,000	288,400	5090.3 persons/year
				Annual Growth Rate
Geometric	1960, 1970	221,300	378,000	3.632%
	1970, 1978	245,100	496,300	4.815%
	1960, 1978	234,500	432,000	4.156%
Decreasing Rate-of-Increase	1975	274,320	468,300	Assumes an accurate population for some future year; technique estimates population in intervening years.*
	1976	269,610	468,300	
	1977	264,664	468,300	
	1978	269,255	468,300	
				County Pop. as % of State
Ratio-and-Correlation	1960	288,600	471,000	29.7% Assumes Nevada
	1970	240,700	392,700	24.8% population of 971,607
	1977	239,400	390,600	24.6% (1985) and 1,585,485
	1978	252,800	412,600	26.0% (2000) as per SPC forecast

*For the purposes of this illustration, the SPC year 2000 forecast for Washoe County has been used as the year 2000 estimate.

Source: Calculated from data presented in Table A-37.

Because neither birth rates nor death rates vary greatly among regions of the United States, disparities in growth rates are attributable primarily to migration. For this reason, demographic forecasting techniques typically build in assumptions about in- and outmigration. These may be age-specific migration rates based on historical observation, or they may be based on analysis of the local economy's growth potential, recognizing that migration into and out of most regions of the county is primarily due to economic factors.

Economic data alone are often used as the basis of a population forecast. Economic growth by sector and employment are forecast first. Then employment forecasts can be translated into an estimate of future households (which can in turn serve as the basis for population estimation). As described in Chapter 3 of this appendix, it is the latter approach Gruen Gruen + Associates has applied to the Reno analysis.

Composite Techniques

It is often the case that elements of projection and forecasting are combined in the prediction of population. For example, in forecasting national population, the Census Bureau considers the number of women in child-bearing age groups and the historic fertility rate (the projection element); it also considers data on the fertility intentions of women in those age groups drawn from survey research (the forecasting element). In general, where information on certain variables which can reasonably be expected to affect future conditions is known or obtainable, use of that information to undertake a forecast or to adjust a projection results in greater accuracy.

The Holding Capacity Concept

A different way of considering the future population of an area is to estimate the level of development its land and resources can accommodate - its "holding capacity". Two regions having the same land area may well have radically different population holding capacities. One region may be level and easily developable whereas the other has rugged terrain or unfavorable foundation conditions. Adverse development indications may include danger of flooding, seismic risk, climatic extremes or lack of a water supply. A holding capacity estimate may take into account as many of these limitations as can be identified, or none of them. In the former case, it might be called an estimate of holding capacity with constraints; in the latter, an estimate of unconstrained holding capacity.

The approach raises the issue of what constitutes a constraint. It has often been observed that, had the growth of Los Angeles been limited to what could be served by its identifiable local water supply, it would not now be the United States' third largest city. Similarly, if steep slopes had resulted in restrictions on construction, both the appearance and the population of San Francisco would be strikingly different. These examples illustrate the fact that seemlingly adverse environmental conditions can often - probably usually - be overcome if the incentive to do so is strong enough. This is not to say that such limitations should be overcome - but it points to the fact that environmental constraints, in the context of the 48 contiguous states, rarely are absolute, and that development limitation decisions based on identified environmental conditions reflect judgment (should development be permitted in a 50-year flood plain? a 100-year flood plain? a 500-year flood plain?) or value-related preferences (should development be permitted on ridge lines?) or both.

In cases in which part of an area is already built up, the estimate of holding capacity reflects the current pattern and degree of urbanization. The estimating procedure may assume that existing built-up areas will remain the same into the future, or that the level of development will intensify. (It rarely would become less intense, though examples, such as the South Bronx, do exist.)

When the holding capacity approach is used, what is estimated is the end-state population, or the population at "build-out". In the year-by-year prediction of population, the analyst is predicting the timing of growth, rather than its total amount, which is given from the estimate of holding capacity.

Problems in Predicting Future Local and Regional Population

Methods of estimating future population are well-developed for larger areas (states and nations); prediction techniques for local areas (counties and cities) are much less reliable. That is because non-demographic influences on population change account for a large proportion of total population change. Generally, local areas experiencing rapid growth are also experiencing large net inmigration rates, and the factors which cause inmigration are not always easy to forecast. An example of a fast-growth area in which inmigration forecasting techniques are critical is the five-county Denver region. In 1975, for example, net inmigration accounted for about 63 percent of Denver's population growth; net natural increase, for 37 percent. Western Nevada counties pose a similar situation.

Typically, inmigration estimates are derived from economic forecasts, as a high proportion of moves are economically-motivated. Thus, especially in large metropolitan areas, for which economic forecasting can be accomplished fairly accurately, inmigration forecasts can also be quite accurate - if uncomplicated by inmigration not related to the metropolitan economy (retirement moves and military moves would not be related to the metropolitan economy and would have to be forecast separately).

For smaller civil units and for rural areas, economic and population forecasting is far less accurate. Economic conditions may alter radically due to difficult-to-predict decisions of individual firms or entrepreneurs, or even of government agencies. The opening or closing of a plant or mine, the establishment or removal of an office or a government facility, may have a substantial impact on a rural area, but is not predictable via standard econometric techniques. And because such events are nonpredictable, population forecasting too has a wide margin of error in rural counties, considerably wider than in metropolitan areas.

The counties of west central Nevada discussed in this appendix - Carson City, Churchill, Douglas, Lyon and Washoe - pose many of the forecasting problems just summarized. Washoe, the metropolitan county, offers farily fertile ground for a sound employment forecast, with the reservation that a well-founded long-range forecast of gaming-related employment is lacking and only a trend forecast is available. The translation of Washoe County employment forecasts into population forecasts is made difficult by a series of complications, including retirement inmigration and the persisting housing shortage, which is causing Reno area jobholders to seek housing in the other four counties (and perhaps elsewhere).

Carson City and the three rural counties are particularly difficult to forecast. Their future employment is more difficult than Washoe's to estimate. Retirement related inmigration is a factor more significant than in Washoe (where the shortage of housing and its increased cost is now discouraging retirees) but how much more significant - and for how many more years - is not known. The Washoe population spillover must also be taken into account in forecasting neighboring counties' growth. And that means, too, that attention must be paid to whether these counties can provide the services - especially water and wastewater treatment - needed to accommodate new arrivals.

To the problems just summarized could be added a host of technical considerations which make west central Nevada a particularly formidable territory for population forecasting. In reviewing or preparing a forecast for the five counties, there is no single "right way" to proceed. The main point is to keep in mind the underlying assumptions of each estimate and the extent to which any available field information was applied to improve the accuracy of the prediction.

Applications of Population Prediction Techniques to Washoe County

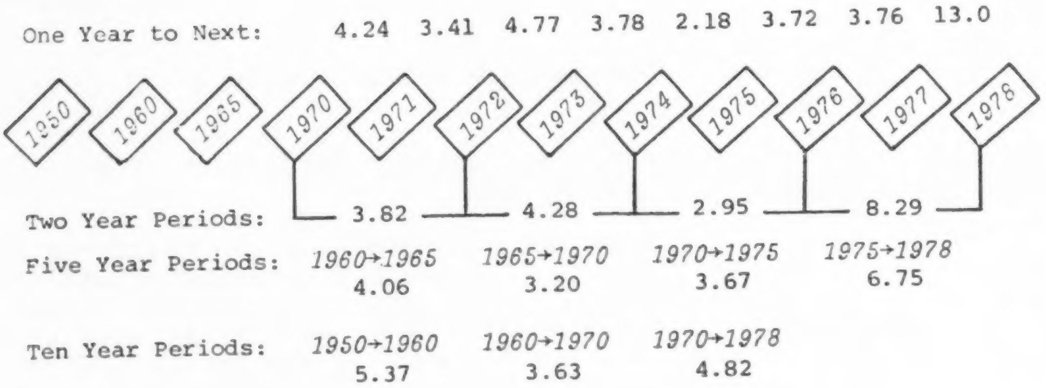
A number of organizations have prepared population projections and forecasts for Washoe County and/or the state of Nevada. The techniques used in these population prediction efforts have varied, and so have the results.

Existing Trends

The preceding description of population prediction techniques describes "projection" as the extrapolation of existing statistical trends. The most obvious approach to trend projection is to apply past growth rates to current population. Of course, past growth rates vary depending on the data from which they are calculated. Figure A-4 provides a summary of recent population growth rates in Washoe County.

Figure A-4

WASHOE COUNTY POPULATION:
ANNUAL GROWTH RATES



Source: Calculated from data presented in Table A-37.

Figure A-4 shows a number of the alternative growth rates on which a projection of county growth might be based. Because the most recent observation (1977-1978: 13.0 percent) is highest, use of that rate would result in a high projection. It frequently is argued that extremely high or extremely low observations are probably attributable to unusual factors that are unlikely to recur. It is for this reason that analysts typically use longer averaging periods than the most recent one or two years - over a long period (say, 1970 to 1978) the extreme highs and lows offset each other. A common rule-of-thumb in projecting trends is to look back as many years as are being forecast.

In Table A-38 a population projection was presented based on the geometric method, which is the application of a constant rate of growth. Table A-39 summarizes the result of the projection-of-existing-trends approach for three of the most reasonable trend lines. The range of projections which results is 432,400 to 496,800 in the year 2000.

Table A-39

PROJECTION OF POPULATION BASED ON EXISTING TRENDS

Trending Period	Growth Rate	Population in: 1985	2000
1970 to 1978	4.16%	234,600	432,400
1965 to 1978	4.19%	235,100	435,100
1970 to 1978	4.82%	245,200	496,800

Source: Calculated from data in Table A-37.

The BBER Forecast: Forecasting Regional Population as a Function of Growth in a Larger Area

The Bureau of Business and Economic Research (BBER) of the University of Nevada/Reno (UN/R) undertook numerous population studies in its prior role as the governor's designated Nevada agency responsible for coordinating local government population work with that of federal agencies such as the Bureau of the Census. The designation lapsed in mid-1978, BBER's most recent population forecast (which is described in this section) having been completed in May 1978.

BBER's major population forecast was completed in March 1977 and revised in May 1978. It uses a variant of what was described as the ratio-and-correlation technique. On the premise that Nevada's economy is closely related to California's, a Nevada growth rate was estimated based on a lagged California growth rate. This step resulted in a state forecast. Then the future growth rates of the larger counties (Clark, Washoe, Carson City) were determined at levels that decline, over time, to the Nevada rate. The state rate first tapers off to California's predicted future growth rate and then to the nation's. The implicit assumption behind this approach is that Nevada's long-run development will increasingly exhibit the characteristics of more fully developed economies - California's and the nation's - as the state grows.

The methodology is not uncommon. However, its validity in the Nevada context was put somewhat in doubt by Washoe

County's rapid growth in the mid-1970's, and, as a result, an adjustment was made to the Washoe County forecast which was intended to reflect more closely the growth pressures specific to the region. The results of this new approach were distributed by BBER in May 1978 and have been used in the Reno/Sparks region in land use, transportation and water quality (208) studies. The work was directed by Dr. Shih-Fan Chu of UN/R and the May 1978 forecast is popularly referred to as "Dr. Chu's numbers".

The approach involved the gathering of information on upcoming development projects in the visitor-gaming-tourist industry in the Reno/Sparks area. With the assistance of the Regional Planning Commission, projects for which permits were being sought and all pre-permit-application projects known to RPC staff were identified. Data on these projects were factored into a 70-industry input/output model developed by UN/R economists, and inter-industry growth impacts of new development estimated. Having estimated total employment, population was then estimated on the basis of employment:population ratios (averaged from several preceding years). Annual forecasts were prepared for 1978, 1979 and 1980; the years beyond 1980 were predicted by projecting the 1978-1980 trend.

When the Washoe County forecast was completed, the forecast for the state and the other counties which had been published in March 1977 was adjusted in light of the change in the Washoe County forecast. The revisions generally increased the state forecast by about 4 percent and Washoe County's by about 10 percent over the March 1977 figures. Table A-40 presents BBER's Washoe County and state forecasts, May 1978 revised version.

Table A-40

BBER POPULATION FORECASTS FOR
WASHOE COUNTY AND THE STATE

	Washoe County	State of Nevada
1980	208,232	763,375
1985	236,547	867,363
1990	267,291	981,288
1995	289,249	1,063,753
2000	322,828	1,160,328

Source: BBER, May 1978

The Regional Planning Commission Forecasts: Unconstrained and Constrained Holding Capacities

The Regional Planning Commission - Reno, Sparks and Washoe County - is the planning agency for both incorporated and unincorporated Washoe County. RPC's population work has not involved original economic/demographic research and analysis, but rather inference of population potential based upon (1) general plan designations and (2) environmental constraints.

In the first case (population potential based on inference from general plan designation) what was involved was the estimation of the population holding capacity of the 1972 Truckee Meadows Regional Plan. That plan, which is the plan currently in effect, exists as a map indicating general plan designations for the Reno/Sparks area. Population can be inferred from it by working from general plan-specified population densities, a process that involves making assumptions about the average density (when a range is permitted) and the extent of buildout. (It has often been observed that development rarely reaches the maximum density permitted by zoning ordinances; thus, it is common to assume that buildout is complete when 75 percent of the maximum permitted density is attained.)

RPC staff has analyzed the 1972 regional plan for the purpose of estimating its implied holding capacity. Their estimate is 915,908 for the 40 drainage subareas constituting the planning area as defined for region-wide water quality planning purposes.

Adoption of the 1972 regional land use plan was followed by preparation of conservation and population plans as required under state statutes (see preliminary report on land use planning). The Population Plan (RPC, June 1975) was prepared in response to the statutory requirement of an "estimate of the total population which the natural resources of the County will support on a continuing basis without unreasonable impairment".

The specific constraints considered in the population plan were water resources, air quality, land and other resources (scenic vistas, archeological and historical resources), all of which are described either in the population plan or in its companion piece, the Conservation Plan. The population plan concluded that "the estimated total population which the natural resources of Washoe County will support on a continuing basis without unreasonable impairment is 616,000 to 1,022,000 persons".

The holding capacity constitutes a very wide range. The fact that the range does include a wide area below the estimated holding capacity of the 1972 land use plan was one of the factors encouraging RPC to update the land use plan using an approach that reflected more specifically environmental constraints on development. That work was completed in 1978. Constraints incorporated into the new holding capacity estimate were slope, erosion hazard, flood hazard, wildlife habitat (all of these posing constraints primarily in the currently undeveloped areas of the region) and existing zoning (a constraint primarily in the currently developed areas of the region). Incorporation of these constraints into the holding capacity estimate results in a downward revision of holding capacity from 916,000 in the 1972 land use plan to 419,000 in the 1978 land use plan. A comparison of the holding capacities estimated from the two plans is presented in Table A-41.

Subappendix A2 presents a summary of the holding capacity analysis conducted by RPC.

The Sierra Pacific Power Company Forecast: One Econometric Approach

The Sierra Pacific Power Company (SPPCo) is the utility responsible for providing electrical power and water to the Truckee Meadows area. SPPCo takes an interest in future levels of population and economic activity because it must plan far in advance for the provision of adequate utility service to growing areas.

SPPCo begin in October 1977 the population forecasting work which resulted in the forecast the company published in 1978. A Bay Area research firm was engaged to assist SPPCo in developing a methodological approach to population forecasting for the service area of the company, which includes Carson City and Douglas County as well as Washoe County. The approach involves use of an econometric model with a separately-derived forecast of basic employment as the major input. This methodology is discussed in Chapter 2, and a schematic representation of the forecasting procedure is presented as Figure A-1, page A-27. Table A-42 sets forth the results of the forecast for Washoe County and its neighbors to the south.

Table A-41

TRUCKEE MEADOWS DWELLING UNITS AND POPULATION: EXISTING (1976) AND HOLDING CAPACITY UNDER PRESENT (1978) AND PRIOR (1972) REGIONAL PLAN

		Dwelling Units			Population		
		Existing:	Capacity:		Existing:	Capacity:	
	Acreage	1976 Count	1978 Plan	1972 Plan	1976 Count	1978 Plan	1972 Plan
CITIES	25,741.0	49,219	95,447	123,780	136,761	250,344	342,576
Reno	18,637.0	36,321	71,996	95,881	98,067	179,991	258,879
Sparks	7,104.0	12,398	23,451	27,899	38,694	70,353	83,697
WATER SERVICE AREAS	51,166.3	59,459	139,049	209,315	167,224	376,876	584,286
SPPCo	45,345.5	55,994	131,724	191,366	156,783	355,655	535,823
Hidden Valley	3,331.1	438	2,491	5,698	1,183	6,727	15,385
Sun Valley	2,086.2	2,800	4,476	11,673	8,589	13,528	31,517
Panther Valley	403.5	227	358	578	669	966	1,561
DRAINAGE SUBAREAS	157,471.1	63,942	158,052	345,241	166,748	419,162	915,908
1 Sun Valley	6,577.1	4,156	7,760	30,945	10,413	20,952	83,551
2 Paradise Park	1,620.3	2,252	10,595	12,365	5,632	26,488	30,914
3 Washoe Co. Fairgrounds - Sierra Vista School	2,412.4	2,243	6,978	10,361	5,608	17,446	25,903
4 Block N - University	3,878.6	3,766	7,966	19,689	9,416	19,667	49,223
5 Peavine	5,352.8	4,849	8,980	12,353	12,123	22,451	30,883
6 Stoker Avenue	1,424.5	1,764	5,069	7,924	2,863	12,675	19,811
7	3,440.6	75	3,643	13,776	203	9,836	37,196
8	4,887.6	142	1,025	9,334	384	2,767	25,202
9	1,844.7	--	374	1,836	--	1,010	4,957
10	3,024.1	--	862	3,148	--	2,333	8,499
11 Hunter Creek	7,578.9	180	764	8,165	486	2,062	22,045
12 Alum Creek	3,744.5	257	2,090	7,330	643	5,226	18,326
13 Hunter Lake Drive	1,256.8	3,295	3,950	5,433	8,238	9,873	13,583
14 Idlewild Drive	471.8	1,873	2,693	2,521	4,683	6,735	6,303
15 Virginia Lake	3,040.1	5,176	8,048	14,028	12,941	20,121	35,071
16 Wells Ave.-Mt. Rose Ave.	1,202.1	4,605	7,383	8,935	11,514	18,459	22,338
17 Gentry Way	1,770.5	2,522	6,567	9,517	6,305	16,419	23,793
18 Hash Lane	2,367.9	2,728	6,770	13,100	6,821	16,927	32,750
19 Evans Creek	6,583.7	299	1,816	7,782	748	4,541	19,456
20 Dry Creek	10,413.8	775	3,788	16,011	1,939	9,472	40,028
21 Thomas Creek	8,048.2	891	2,012	8,178	2,406	5,433	22,080
22 White's Creek	10,085.9	603	3,197	9,067	1,628	8,634	24,481
23	2,075.1	47	509	1,911	127	1,374	5,160
24 Not in Planning Area							
25	479.1	50	132	400	135	356	1,080
26 Virginia Foothills-Va. Range	11,345.0	2,581	3,527	12,329	6,969	9,523	33,289
27 Alexander Lake	5,628.4	18	1,525	10,926	49	4,117	29,501
28 Hidden Valley	3,567.4	550	2,034	4,603	1,485	5,493	12,428
29 Boynton Slough	1,811.3	548	4,327	7,283	1,481	11,683	19,664
30 Matley Lane-Airport	1,365.5	1,450	3,011	1,356	3,626	7,529	3,391
31 University Farm	1,605.0	--	181	193	--	489	521
32 MGM Lake-Mill St.	855.2	586	805	16	1,467	2,013	40
33 Glendale-Marietta Way	1,124.1	1,178	1,395	2,407	3,535	4,185	7,221
34 Glendale-Kleppe Lane	1,446.3	113	--	--	339	--	--
35 Central Sparks	2,826.6	9,400	17,111	18,363	28,200	51,333	55,089
36 East Sparks	7,440.0	491	9,429	17,974	1,473	28,287	53,922
37 North Sparks	1,523.2	2,582	4,314	6,215	7,746	12,942	18,645
38 Spanish Springs	4,824.6	237	419	7,700	640	1,132	20,790
39 S.E. Lemmon Valley	9,231.9	1,637	5,723	13,069	4,420	15,452	35,287
40 Silver Lake	3,144.5	16	1,173	2,420	43	3,168	6,537
41 Spanish Springs East	6,150.5	7	207	6,278	19	559	16,950

Source: Regional Planning Commission files; 1976 count tabulated by URS; 1972 and 1978 capacity estimates tabulated by Gruen Gruen + Associates.

Table A-42

SIERRA PACIFIC POWER COMPANY POPULATION FORECAST FOR WASHOE COUNTY

Year	Washoe County	Carson City	Douglas County
1970	121,068	15,468	6,882
1978	164,961	29,415	13,751
1979	179,277	30,516	14,812
1980	194,783	31,671	16,125
1981	210,869	32,970	17,542
1982	226,222	34,389	18,966
1983	240,214	35,896	20,396
1984	254,193	37,605	21,834
1985	268,261	39,459	23,276
1986	282,394	41,421	24,719
1987	296,952	43,463	26,162
1988	311,988	45,565	27,604
1989	327,484	47,710	29,044
1990	343,408	49,885	30,482
1991	359,918	52,079	31,915
1992	377,033	54,288	33,343
1993	394,756	56,505	34,767
.			
.			
.			
2000	[ ]*	N.A.	N.A.

*A year 2000 projection of 540,000 is widely attributed to, but has been disavowed by, Sierra Pacific Power Company.

Source: SPPCo, 1978

SPPCo has cautioned those reviewing its forecasts with regard to a number of important limitations affecting the accuracy of the model's output. For one thing, the model contains no constraints on development. "Possible air quality, water availability, and sewage capacity limits were not incorporated in the simulation of this model." For another, the forecast is not adjusted for likely future in-commuting to jobs in Washoe County from residences outside. Population in the model is treated as a function of employment. As employment rises, population will increase, too. But SPPCo points out that "a portion of the population supported by employment in Washoe County may be commuting daily from Portola, California or Fernley, Nevada." To the extent that the proportion of jobs held by in-commuters rises in coming years, the model overestimates Washoe County population growth.

The State Planning Coordinator's Forecast: A Second Econometric Approach

Nevada's governor requested the State Planning Coordinator to undertake a population forecast for the state and its counties in 1978. This work was accomplished with the assistance of a Utah-based research firm. Like the SPPCo approach, the forecast is based on an employment-driven econometric model. The methodology is discussed in Chapter 2, beginning at page A-26. Table A-43 presents the SPC forecast for Washoe County. Nevada's Employment Security Department, Employment Security Research (ESR), began a revision of the forecast in 1979 but it was subsequently abandoned.

Table A-43

STATE PLANNING COORDINATOR'S POPULATION FORECAST
FOR WASHOE COUNTY AND THE STATE OF NEVADA

	SPC Forecast (10-10-78)	
Year	Washoe County	State of Nevada
1978	176,368	677,803
1979	196,679	722,209
1980	216,989	766,615
1981	299,140	807,612
1982	241,290	848,610
1983	253,441	889,611
1984	265,591	930,609
1985	277,742	971,607
1990	337,900	1,192,645
1995	404,300	1,384,104
2000	468,300	1,585,485

Source: State Planning Coordinator, October 10, 1978.

The State Planning Coordinator's forecast has the same major limitations as that of Sierra Pacific Power Company. It does not reflect resource constraints. It does not address the issue of possible changes in the distribution of housing locations vis-a-vis jobs (the in-commuting problem). Finally, the SPC forecast is based on an economic data series ending in 1975. Because growth since then has been substantial, the original SPC forecast has already been updated with the assistance of ESR, so that 1976-1978 employment growth is incorporated into the forecasts.

The Bureau of Economic Analysis Population Projections by State: A Composite Approach

The Bureau of Economic Analysis (BEA) is an agency of the U. S. Department of Commerce which prepares a comprehensive set of subnational economic projections as part of its regular work program. BEA directs the preparation of the population and economic projections known as the OBERS projections - an acronym reflecting a joint effort by BEA (formerly the Office of Business Economics) and the Economic Research Service of the U. S. Department of Agriculture. OBERS projections are prepared every five years; the 1972 projections were published in 1974, and the 1977 projections are expected to be published late in 1979.

The U. S. Environmental Protection Agency (EPA) uses BEA projections in many of its planning programs. EPA contracted with BEA to prepare revised state-level projections to the year 2000, incorporating the most recent historical data. BEA agreed to prepare such projections independently of its regular OBERS update timetable. The work for EPA incorporates some of the revisions BEA is incorporating into the next OBERS series, including factoring in actual population change since 1970 and augmenting the base data to reflect the estimated 1970 census undercount. However, BEA notes that its update for EPA is not part of the regular OBERS cycle (meaning, presumably, that the range of error is broader than BEA usually strives for in its OBERS work).

Table A-44 presents Nevada near 2000 and intermediate projections by BEA under the most recent OBERS series and under the projections prepared for EPA (BEA, 1977). The updating work by BEA resulted in a 30 percent increase in Nevada's year 2000 projection. Looking at the revision another way, Nevada will reach in the year 2000 a population level it was not projected to reach until after 2020 in the 1972 OBERS series (BEA, 1974).

Table A-44

BEA POPULATION PROJECTIONS FOR NEVADA

	1980	1985	1990	2000	2020
OBERS 1972 Series	615,600	684,300	760,000	881,500	1,107,400
EPA Series	714,000	827,000	939,000	1,141,000	not tabulated
OBERS 1977 Series					

Source: BEA 1974 and BEA 1977

Summary Comparison of Projections and Forecasts

In the preceding sections, a series of approaches to predicting the future population of Washoe County and/or the State of Nevada were described. These approaches differ from one another in method and in type and source of data. The results also differ; Table A-45 presents a summary of the conclusions for the year 2000 and three intermediate years.

Table A-45

SUMMARY OF POPULATION PROJECTIONS AND FORECASTS FOR WASHOE COUNTY

	1980	1985	1990	2000
Existing Trends (1970-1978)	193,800	245,200	310,300	496,800
Bureau of Business and Economic Research, UNR	208,232	236,547	267,291	322,828
Sierra Pacific Power Company	194,783	268,261	343,408	---[1]
State Planning Coordinator	216,989	277,742	337,900	468,300
Bureau of Economic Analysis:[2]				
OBERS 1972 Series	153,900	171,075	190,150	220,375
EPA 1977	178,500	206,750	234,750	285,250
OBERS 1977 Series				

[1] A year 2000 projection of 540,000 is widely attributed to, but has been disavowed by, Sierra Pacific Power Company.

[2] BEA did no county projections. The figures in this table assume Washoe County's share of the state population will be 25 percent, which is about its historic share.

Source: Preceding tables in this subappendix.

The comparison shows, among other things, that nationally-based econometric forecasts by BEA are consistently lower than those based on state (or on state and regional) data. This difference is more likely to be attributable to the inability of national economic models to take into account the unique character of the Nevada economy, rather than local boosterism or pro-growth mentality. The OBERS 1977 Series, when published, will shed more light on this gap.

The existing trends projection yields the highest year 2000 figure - 296,800. RPC has calculated the Truckee Meadows holding capacity as 419,162 (Table A-41). That would make the county holding capacity about 495,000, which is the mid-point of an ultimate county population range of 466,000 to 524,000.* If 1970-78 trends continue, then, Washoe County would be "built out" by the year 2000 according to RPC's holding capacity analysis.

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*The lower end of the range would apply if a fully-urbanized Truckee Meadows accounts for 90% of the county's population (Crowe, pers. comm.); the upper end of the range would apply if the Meadows accounts for 80% of the county's population (which has generally been the case in the past).

SUBAPPENDIX A3

FORECASTS OF EMPLOYMENT GROWTH IN THE STATE OF NEVADA

Employment growth in the State of Nevada as well as in Washoe County (see Chapter II) has been forecast by both the State Planning Coordinator's Office (SPC) and the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). Like the county projections, the statewide projections differ significantly. The differences over the forecast period are shown in Figure A-5.

Forecast by the Bureau of Economic Analysis

The BEA projection was prepared as part of the OBERS effort in 1972. State forecasts were based on the projection for the nation as a whole and on the distribution of that projection among economic areas of the country.

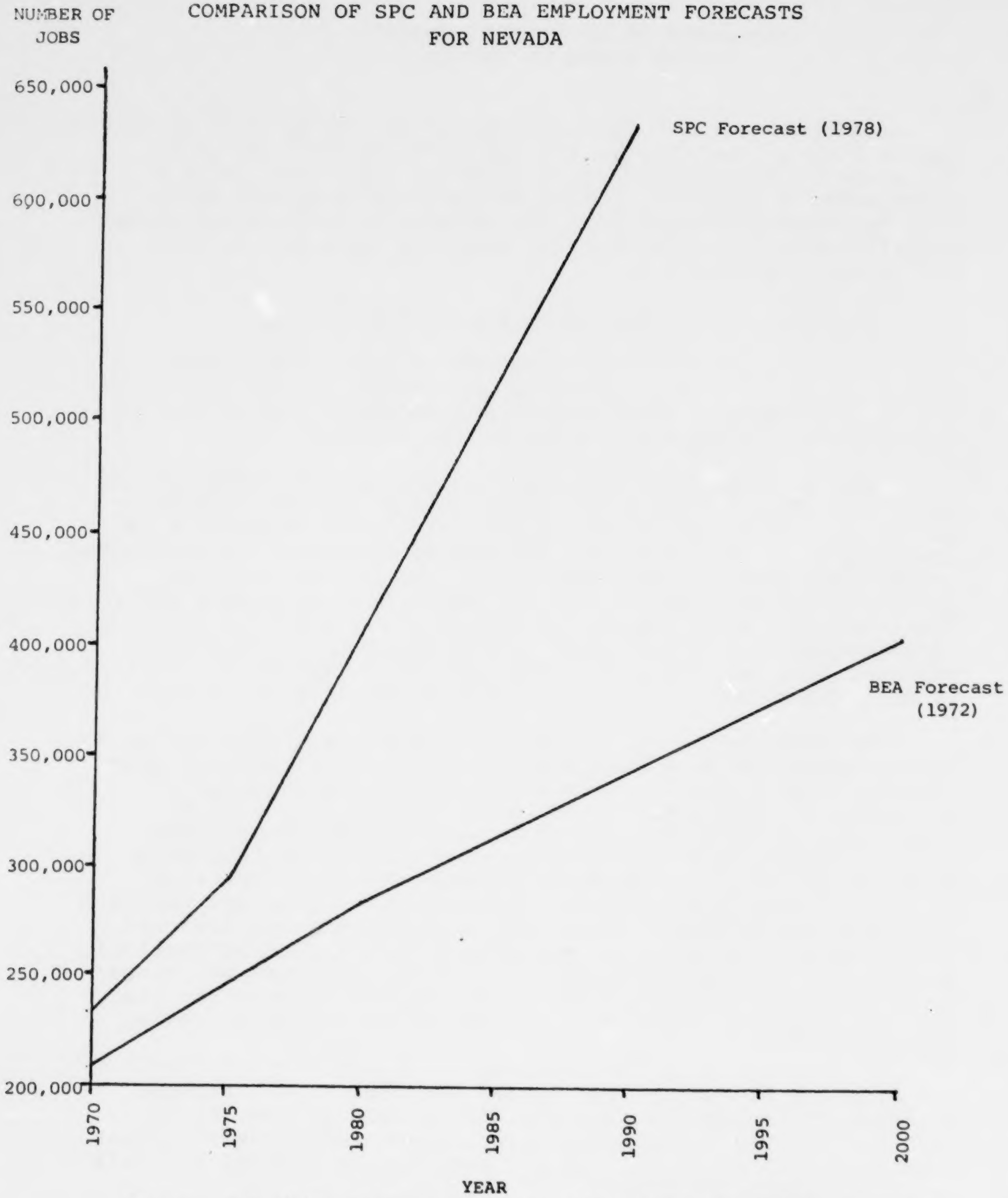
More specifically, the national projection was allocated among the 173 economic areas based on the premise that population is a function of employment, with some adjustment in recognition of the fact that retirement migration is significant among those aged 65 and over. Thus, the two assumptions governing the allocation were (1) that labor pool-aged and pre-labor pool aged population (15-64 years and 0-14 years, respectively) are distributed proportionately to employment opportunities and (2) post-labor pool-aged population (65+) is distributed similarly to the population aged 55 to 64.

The distribution of projected economic activity and population among the 50 states was then based on a two-step procedure. First, the 173 economic areas were disaggregated according to geographic boundaries; that is, any economic area lying in more than one state was divided along state lines. (Nevada has one economic area that falls into more than one state; it encompasses Lincoln and Clark Counties as well as Washington County, Colorado and Mojave and Coconino Counties, New Mexico.) Each component subarea was assigned its historic proportion of economic activity (and population). Second, the historic proportion for each component was translated into an absolute (real) value for each projection year, and the component areas were aggregated according to state boundaries.

The BEA projection for Nevada anticipates a statewide increase in employment from 209,400 in 1970 to 344,500 in 1990 and 480,900 in the year 2020. These increases represent average growth rates of 2.5% per year during 1970-90 and 1.7% per year during 1970-2020.

Figure A-5

COMPARISON OF SPC AND BEA EMPLOYMENT FORECASTS FOR NEVADA



Source: U.S. Water Resources Council, 1972 OBERS Projections; Governor's Office of Planning Coordination, Nevada's Demographic and Economic Impact Simulation Model, Model Description and Baseline Projections, December 1978.

When the OBERS projections for Nevada and Washoe County are compared, they indicate that the county would capture nearly 31% of the state's employment growth between 1970 and 1990, growing from 25.7% of the state's jobs in 1970 to 27.6% in 1990. These figures are presented in Table A-46.

Table A-46

BEA (OBERS) EMPLOYMENT PROJECTIONS FOR
NEVADA AND WASHOE COUNTY

Year	Statewide Employment	Average Annual Increase	Washoe County Employment	Average Annual Increase	Washoe Co. as % of State
1970	209,400		53,830		25.7%
1980	284,200	3.1%	75,000	3.4%	26.4
1985	312,900	1.9	84,400	2.4	27.0
1990	344,500	1.9	95,100	2.4	27.6
2000	403,600	1.6	114,800	1.9	28.4
2020	480,900	0.9	141,600	1.9	29,4

Source: U.S. Water Resources Council, 1972 OBERS Projections, volumes 4 and 5.

Forecast by the State Planning Coordinator's Office

The State Planning Coordinator's forecasting model aggregates the projections for all Nevada counties into a statewide estimate of future employment. Therefore, the assumptions governing the statewide forecast are essentially the same as those which govern the county forecasts (see Chapter 2, page A-26).

The SPC forecast, prepared in 1978, projects statewide employment growth from 234,757 jobs in 1970 to 634,500 in 1990. This increase would represent average annual growth of about 5.1%.

Together, the SPC projections for Nevada and Washoe County anticipate that the county would capture approximately 26% of the state's job growth between 1970 and 1990. By doing so, the county's share of all jobs in the state would increase from 26.7% in 1970 to 31.1% in 1990. These figures are shown in Table A-47.

Table A-47

SPC EMPLOYMENT PROJECTIONS FOR NEVADA AND WASHOE COUNTY

Year	Statewide Employment	Average Annual Increase	Washoe County Employment	Average Annual Increase	Washoe Co. as % of State
1970	234,757		62,676		26.7%
1975	296,100	4.8%	80,510	5.1%	27.2
1980	413,000	6.9	128,100	9.7	31.0
1985	524,200	4.9	163,800	5.0	31.2
1990	634,500	3.9	197,100	3.8	31.1

Source: State Planning Coordinator, Nevada's Demographic and Economic Impact Simulation Model, December 1978.

SUBAPPENDIX A4

METHODOLOGY FOR FORECASTING HOUSING DEMAND

The demand for housing units in Truckee Meadows in the future may be estimated by examining the current and past patterns of demand in the Reno-Sparks area. Data from the 1970 U. S. Census provide the most comprehensive information available and may be presumed to summarize recent demand characteristics through that time. (Some of those characteristics may have changed since 1970, but data describing the changes are not yet available.)

Estimating the Types of Units Sought

The demand for housing may be categorized in a number of ways. Perhaps most important for this EIS analysis are type of tenure (owner-occupancy vs. renter-occupancy) and type of structure (single-family, multiple-family or mobile home). The characteristics of both these categories, however, change according to income group; for example, lower income households are more likely to be renters than owners and higher income households are more likely to be owners. Therefore, the demand forecasting methodology begins with a look at household incomes.

Distribution of Household Income

The 1970 Census revealed that in 1969 one-fourth of all Washoe County households had incomes of less than $5,000 and only 5 percent had incomes of more than $25,000. (It must be remembered that inflation between 1970 and the present has altered people's perceptions of income levels; for example, $5,000 in 1970 would have been worth $7,330 in 1976 dollars and $8,400 in 1978 dollars; $25,000 in 1970 would have been worth $36,650 in 1976 dollars and $42,000 in 1978.) The complete distribution of households among income groups in 1970 is presented in Table A-48.

Between 1969 and 1975, real per capita income grew at an average rate of 1.6% per year; in other words, average earnings increased that much more than inflation. Thus, the household whose income was reported as $10,000 in the 1970 Census likely had an income of $16,500 in 1975,* but that income probably had the purchasing power of an $11,900 income in 1970.

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*Income reported in the 1970 Census were earned in 1969. Household size did not change enough during that period to require an adjustment from per capita income to household income.

Table A-48

DISTRIBUTION OF RENO HOUSEHOLDS AMONG INCOME GROUPS IN 1970

Income (1969 Dollars)*	Percentage of All Households
Less than $5,000	25%
$5,000 - $9,999	29
$10,000 - $14,999	24
$15,000 - $24,999	17
$25,000 or more	5

*Income reported in the 1970 Census were earned in 1969.

Source: U. S. Census of Housing, Metropolitan Housing Characteristics, Reno, Nev. SMSA, 1970 (Table A-6).

The 1.6% annual growth rate has been a typical one for recent years, but there are doubts as to whether it will be maintained in the future and especially in the next 10 years (through 1990). Given national economic conditions, the tendency of Reno's service sector wages not to keep up with inflation and recent housing price increases that are expected to continue, it is estimated for this forecast that real incomes will not continue to outpace inflation. It is possible that the greater expense of living in Reno (compared to the past) will discourage retirees and others on fixed incomes from moving into the area and the average household income would consequently rise, but an analysis of that possibility is beyond the scope of this EIS.

Therefore, it is assumed for this forecast that the household income distribution that prevailed in Washoe County in 1975 will prevail throughout the study period. That distribution is shown in Table A-49. (The table and subsequent analysis present the 1975 household income distribution in 1969 dollars to facilitate references to the 1970 Census data; the distribution will be translated to 1978 dollars at the end of the methodology discussion.) The figures in Table A-49 indicate a slight shift to higher income groups.

Table A-49

DISTRIBUTION OF HOUSEHOLDS
AMONG INCOME GROUPS IN 1975

Income (1969 Dollars)	Percent of Households
Less than $5,000	23%
$5,000 - $9,999	28
$10,000 - $14,999	25
$15,000 - $24,999	17
$25,000 or more	7

Source: Gruen Gruen + Associates

Type of Tenure Sought

In 1970, owner-occupants in Washoe County outnumbered renters, 57.4% to 42.6%. As suggested above, though, this nearly-even split was not maintained across all income groups. The owner-renter characteristics of each group are presented in Table A-50.

Table A-50

DISTRIBUTION OF INCOME GROUPS AND HOUSING TENURE FOR
DIFFERENT INCOME GROUPS IN WASHOE COUNTY, 1970

Income (1969 Dollars)	% of This Income Group that are Owner-Occupants	% of this Income Group that are Renter-Occupants
Less than $5,000	37%	63%
$5,000 - $9,999	48	52
$10,000 - $14,999	68	32
$15,000 - $24,999	79	21
$25,000 or more	85	15

Source: U. S. Census of Housing, Metropolitan Housing Characteristics, Reno, Nevada, SMSA, 1970 (Table A-6).

Combining these characteristics with the 1975 household distribution in Table A-49 results in the tenure-and-income distribution shown in Table A-51 .

Table A-51

TENURE-AND-INCOME DISTRIBUTION OF WASHOE COUNTY HOUSEHOLDS (Percent of All Households)

Income (1969 Dollars)	Owner-Occupants	Renter-Occupants	Total
Less than $5,000	9	14	23
$5,000 - $9,999	13	15	28
$10,000 - $14,999	17	8	25
$15,000 - $24,999	13	4	17
$25,000 or more	6	1	7
TOTAL	58	42	100

Source: Gruen Gruen + Associates

It may be noted that Table A-51 shows 58% owner-occupants while the 1970 Census shows 57% owner-occupants. The difference shows results from use of the 1975 household income distribution, which assigns a slightly greater percentage of households to the income groups that are more likely to be owner-occupants.

Type of Structure Sought

Housing options may be described not only in terms of tenure but also in terms of the type of unit occupied. Units may be divided into three types: single-family, multiple-family and mobile home. Housing structure types occupied by Reno households in various income and tenure groups in 1970 are shown in Table A-52.

Table A-52

WASHOE COUNTY HOUSEHOLDS BY INCOME GROUP BY STRUCTURE TYPE AND TENURE, 1970

	Owner-Occupants			Renter-Occupants		
Income (1969 Dollars)	Single-Family Structure	Multi-Family Structure	Mobile Home	Single-Family Structure	Multi-Family Structure	Mobile Home
Less than $5,000	66	5	29	25	71	4
$5,000 - $9,999	70	5	25	34	63	3
$10,000 - $14,999	83	3	14	46	51	3
$15,000 - $24,999	90	3	7	48	50	2
$25,000 or more	96	2	2	41	59	0

Source: U. S. Census of Housing, Metropolitan Housing Characteristics, Reno, Nevada, SMSA, 1970 (Table A-6).

This distribution, too, may be applied to the 1975 distribution of households by income group to yield the overall distribution of tenure and structure types presented in Table A-53.

Table A-53

INCOME, TENURE AND STRUCTURE TYPE
DISTRIBUTION OF WASHOE COUNTY HOUSEHOLDS
(Percent of All Households)

	Owner-Occupants			Renter-Occupants			
Income (1969 Dollars)	Single-Family Structure	Multi-Family Structure	Mobile Home	Single-Family Structure	Multi-Family Structure	Mobile Home	Total
Less than $5,000	6	0	3	4	10	0	23
$5,000 - $9,999	9	1	3	5	10	0	28
$10,000 - $14,999	14	1	2	4	4	0	25
$15,000 - $24,999	12	0	1	2	2	0	17
$25,000 or more	6	0	0	.5	.5	0	7
TOTAL	47	2	9	15.5	26.5	0	100

Source: Gruen Gruen + Associates

The final steps in estimating future housing demand are (1) translating incomes into a more recent currency - e.g., 1978 dollars - so that they may be compared to housing prices and (2) defining the threshold amount of income needed to qualify for a mortgage on a new home.

Translating Household Income Categories

The translation of household incomes into a more recent year than 1969 must consider two components: inflation and real income growth. Inflation may be considered by using the change in the consumer price index (CPI)* to estimate the number of dollars required in 1975, for example, to purchase the same goods bought with a smaller number of dollars in 1969. This procedure is carried out using the following equation:

$$\text{1975 Dollars} = \text{1969 Dollars} \left(\frac{\text{CPI in 1975}}{\text{CPI in 1969}}\right)$$

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*The Consumer Price Index (CPI) is a relative scale used to compare the prices of consumer goods at different points in time. The current scale is based on the year 1967, so that the CPI in 1967 = 100.

For example, an income of $5,000 in 1969 could be adjusted to 1975 Dollars as follows:

$$1975 \text{ Dollars} = \$5{,}000 \left(\frac{161.2}{109.8}\right)$$

$$= \$7{,}340$$

Thus, an income of $5,000 in 1969 would have been equal in purchasing power to an income of $7,340 in 1975.

Real income growth is the amount by which incomes exceed inflation during a period of time. For example, if a household earned $5,000 in 1969 and $8,000 in 1975, the amount greater than that required to keep up with inflation ($8,000 - $7,340, based on the previous example) would have been real income growth. As noted before, real income growth in the Reno SMSA occurred at an average rate of 1.6% per year between 1969 and 1975.

Therefore, the changes in household income levels in Washoe County between 1969 and 1975 may be estimated as in Table A-54.

Table A-54

CHANGES IN HOUSEHOLD INCOME LEVELS BETWEEN 1970 AND 1975 FOR WASHOE COUNTY

Income in 1970 Census[1]	→	Adjusted for Real Income Growth	→	Adjusted for Inflation (1975 Dollars)[2]
Less than $5,000		Less than $5,500		Less than $8,075
$5,000 - $9,999		$5,500 - $10,999		$8,075 - $16,149
$10,000 - $14,999		$11,000 - $16,499		$16,150 - $24,224
$15,000 - $24,999		$16,500 - $27,499		$24,225 - $40,374
$25,000 or more		$27,500 or more		$40,375 or more

[1] 1969 Dollars

[2] CPI in 1969 = 109.8; CPI in 1975 = 161.2

Source: Gruen Gruen + Associates

It is desirable for the purpose of this EIS to carry the translation of household income levels as far forward as possible in order to reflect housing market conditions after the beginning of Reno's growth spurt, which approximately coincides with the opening of MGM Grand Hotel in 1978. The most recent year for which an annual average consumer price index has been published (as of July 1979) is 1978. As noted on page A-91, it is assumed in this EIS that real incomes will not grow - that is, incomes will not outpace inflation - between 1975 and the end of the study period. Table A- translates the 1975 estimated household income levels to 1978 dollars with no adjustment for real income growth. Incomes as reported in the 1970 Census are included for reference.

Table A-55

TRANSLATION OF HOUSEHOLD INCOME LEVELS FROM 1975 DOLLARS TO 1978 DOLLARS

Income in 1970 Census[1]	Income in 1975 Dollars	Income in 1978 Dollars[2]
Less than $5,000	Less than $8,075	Less than $9,799
$5,000 to $9,999	$8,075 - $16,149	$9,800 - $19,574
$10,000 - $14,999	$16,150 - $24,224	$19,575 - $29,374
$15,000 - $24,999	$24,225 - $40,374	$29,375 - $48,949
$25,000 or more	$40,375 or more	$48,950 or more

[1] 1969 Dollars.
[2] CPI in 1978 = 195.4

Source: Gruen Gruen + Associates

The estimated income-tenure-structure type distribution for Reno SMSA households (Table A-53) is presented again here as Table A-56 with household incomes translated to 1978 dollars.

Table A-56

INCOME-TENURE-STRUCTURE TYPE DISTRIBUTION FOR WASHOE COUNTY HOUSEHOLDS (INCOMES IN 1978 DOLLARS) (% of All Households)

	Owner-Occupants			Renter-Occupants			
Income (1978 Dollars)	Single-Family	Multi-Family	Mobile Home	Single-Family	Multi-Family	Mobile Home	Total
Less than $9,799	6	0	3	4	10	0	23
$9,800 - $19,574	9	1	3	5	10	0	28
$19,575 - $29,374	14	1	2	4	4	0	25
$29,375 - $48,949	12	0	1	2	2	0	17
$48,950 or more	6	0	0	.5	.5	0	7
TOTAL	47	2	9	15.5	26.5	0	100

Source: Gruen Gruen + Associates

Estimate of Demand for Housing in Truckee Meadows

Historically, about 80% of the households in Washoe County have lived in Truckee Meadows, and it is therefore reasonable to assume that the Meadows area will attract the same proportion of new households in the future. Because the Meadows is more urbanized than the rest of the county, however, it is assumed in this forecast that all households wishing to rent housing units in multi-family structures will locate there. It is further assumed that the rest of the housing demand will be spread proportionately among the remaining income-tenure-structure type categories. These assumptions have the effect of assigning approximately 72% of the households desiring other than multi-family rental units to Truckee Meadows, and yield the demand distribution presented in Table A-57. It is interesting to note that this adjustment slightly shifts the overall income distribution of households assigned (or assumed to prefer) Truckee Meadows, and that the new distribution more closely approximates the distribution of Reno households described by the 1970 Census.

Table A-57

INCOME-TENURE-STRUCTURE TYPE DISTRIBUTION FOR
TRUCKEE MEADOWS HOUSEHOLDS
(% of All Households)

	Owner-Occupants			Renter-Occupants			
Income (1978 Dollars)	Single-Family	Multi-Family	Mobile Home	Single-Family	Multi-Family	Mobile Home	Total
Less than $9,799	5	0	3	4	13	0	24
$9,800 - $19,574	8	1	3	5	13	0	29
$19,575 - $29,374	13	1	2	4	5	0	24
$29,375 - $48,949	11	0	1	2	2	0	16
$48,950 or more	5	0	0	*	1	0	7
TOTAL	43	2	9	15	34	0	100

N.B. Detail may not add to totals because of rounding.

Source: Gruen Gruen + Associates

SUBAPPENDIX A5

DESCRIPTION OF THE GEOGRAPHIC SCOPE OF TRUCKEE MEADOWS

The *Land Use Plan* for Truckee Meadows, published by the Regional Planning Commission (RPC) in October 1978, describes Truckee Meadows as the area bounded "on the north by the Sun Valley and Spanish Springs Valley watersheds; on the south by the Steamboat area; the Virginia Mountains to the east; and on the west by the Carson Range." This area, according to the plan, covers approximately 160 square miles (102,400 acres). It includes the cities of Reno and Sparks and the unincorporated area to the south approximately as far as Tahoe Junction (the intersection of US395 and State Route 27*). It includes Steamboat but not Steamboat Valley (south of the town). It also includes the area served by the TransSierra Water District.

The eastern boundary of the Meadows runs approximately along the Washoe-Storey County line for most of its distance. Where the county line turns east along the Truckee River (east of Vista), the boundary of the Truckee Meadows planning area continues north to a point parallel with the northern boundary of the Sierra Pacific Power Company's water service area.

The northern boundary of the planning area travels straight west from that point, consequently taking in Sparks and most of Reno but excluding Spanish Springs Valley, Sun Valley, Panther Valley, Lemmon Valley, Black Springs, Golden Valley and Reno-Stead. It continues west past the Reno city limit and the SPPCo water service boundary and then turns south, crossing I-80 at a point west of the Lawton interchange.

The western boundary south of I-80 runs directly south, parallel to the California border, to a point approximately parallel with the town of Steamboat.

The southern portion of the Truckee Meadows planning area excludes an area known as the Galena Fan, which lies west of Steamboat and south of an imaginary extension of Lakeside Drive in Reno.

The Truckee Meadows planning area, as described above, is roughly the same as the non-attainment plan (NAP) boundary shown on the map that Jones & Stokes sent us, except it (Truckee Meadows) excludes some land in the southeast and northeast corners of the NAP area. The excluded land in the southeast corner is a mountainous area.

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*The new state route number is 431.

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The socioeconomic portions of this EIS use a definition of Truckee Meadows which includes two areas not included in the Truckee Meadows plan and non-attainment plan: Stead and Spanish Springs. These two areas were included because they are included in Jones & Stokes's request for dwelling unit estimates by air quality area. (Chapter 4 projects construction of 600 to 4,100 single-family units in Stead and 475 in Spanish Springs; 600 in Stead and all the units in Spanish Springs were under construction when interviews were conducted in May 1979.)

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2/2/79	Richards, Walt Assistant Engineer Fallon Public Works	Water availability and sewage treatment in Fallon.
3/20/79	Rigsby, Bob State Planning Coordinator's Office	Population model; completion of documentation.
3/21/79	Sandford, Jim, Editor Mason Valley News	Industrial development in Lyon County.
5/4/79 5/8/79	Selender, Bjorn County Manager Churchill County	Residential development, wastewater treatment and water availability in Churchill County.
1/19/79 1/22/79	Smith, Art, Chairman of the Board First National Bank of Nevada	Update on Parry's Reno study.
5/4/79	Spezzi, Stan, Planning Director Lyon County Planning Department	Wastewater treatment and water availability in Lyon County.

12/6/78	Sullivan, Bob CRBCOG	Origin of CRBCOG; issues.
1/5/79	Thompson, Viki Federal Ins. Admin.	Flood plain mapping, Truckee Meadows.
10/27/78 2/8/79 5/30/79 7/11/79	Tierney, Keith Nevada State Planning Coordinator's Office, Office of the Governor	Nevada economic model; Washoe County population projections.
3/30/79	Tilson, Wilfred R. The Senior Citizens of Lyon County	Senior citizen complex in Yerington.
12/1/78	Ward, Tim Nevada Highway Dept.	Traffic counts.
1/26/79 3/1/79	Walters, Patty SPPCo.	SPPCo. population projections.
4/30/79	Whitcome, Shirley Growth Management Officer - Carson City Public Works	Water availability and wastewater treatment capacity in Carson City.
5/15/79	Williams, Belie B. CWR Enterprises	Future residential development.
3/22/79	Wood, Leona Carson City Chamber of Commerce	Industry in Carson City.
10/9/78	Young, Tom Nevada Environmental Action Trust	Area growth; growth problems and prospects.

Reno-Sparks Joint Water Pollution Control Plant Master Project

Draft Environmental Impact Statement

Appendix B

Air Quality

Prepared for:

U. S. Environmental Protection Agency
Region IX

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B-0

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APPENDIX B

The following air quality appendix supplements information presented in the EIS and includes discussions of meteorology, emissions forecasts and air quality monitoring.

Meteorology

Introduction

Meteorological factors are important to consider from several perspectives when evaluating air quality issues. Factors such as temperature, humidity, and the intensity and duration of sunlight play important roles in governing the nature and rate of chemical reactions in the atmosphere.

Atmospheric turbulence, wind patterns and vertical temperature gradients are important factors governing the distribution and dispersion of pollutants. Atmospheric turbulence, wind patterns and precipitation processes affect the rate at which pollutants are removed from the atmosphere.

Topographic Influences

At an elevation of approximately 4,400 feet, Truckee Meadows is part of a large semiarid plateau. Since Truckee Meadows lies in the lee of the Sierra Nevada Mountains, precipitation is fairly sparse. To the west the Sierra Nevada rise to over 10,000 feet, while the hills to the east reach 6,000 feet. The Truckee Meadows is a valley 10 miles wide and 16 miles long, and effectively forms a distinct air basin.

Wind Patterns

Wind patterns near ground level are influenced significantly by topography. Ground level winds may also be significantly different (in regard to both velocity and direction) from winds at higher altitudes. The presence of inversion layers also influences, and is influenced by, wind patterns.

Winds in Truckee Meadows are extremely variable, as influenced by the surrounding mountainous terrain. Light to moderate wind speeds predominate (Table B-1). The

Table B-1. Mean Wind Speeds and Direction by Month at Reno International Airport

Month	Mean Speed m.p.h.	Prevailing Direction
January	5.8	S
February	6.1	S
March	7.6	WNW
April	8.1	WNW
May	7.7	WNW
June	7.3	WNW
July	6.7	WNW
August	6.3	WNW
September	5.5	WNW
October	5.3	WNW
November	5.2	S
December	5.0	SW
Annual	6.4	WNW

NOTES:

Length of record for speed = 36 years
Length of record for prevailing direction = 15 years

SOURCE: National Oceanic and Atmospheric Administration, 1978.

prevailing directions of wind are from the west-northwest and the south. During the winter months the Truckee Meadows generally experiences light winds, especially during the night. Drainage winds during the night typically form stable conditions.

Precipitation

Normal annual precipitation in water equivalent for Reno is 7.2 inches. Greater than half of this total falls during the period December through March. Although there is an average of 25 inches of snow a year, little snow accumulates on the valley floor. Summer rain comes mainly as brief thundershowers in the middle and late afternoons (National Oceanic and Atmospheric Administration, 1978).

Other Meteorological Parameters

Additional meteorological features of the Truckee Meadows area include its low humidity and high incidence of sunshine, especially during the summer months. The average summertime (June-September) relative humidity in Reno is 21 percent. The average number of days that are clear, partly cloudly, and cloudy in Reno are 164, 91, and 110, respectively (National Oceanic and Atmospheric Administration, 1978).

Temperature Inversions

Under "normal" conditions, sunlight warms land surfaces which in turn heat the air at ground level by conduction and reradiation of heat. When heated sufficiently, a pocket or "cell" or warmed air will expand and rise, being displaced by cooler, denser air from above. As it rises, the cell of warm air will expand further due to decreasing pressure at higher altitudes causing the temperature of the air cell to drop. The air cell will continue to rise, expand in volume, and cool until it reaches an altitude where it is at the same temperature and pressure as surrounding air masses. This rising of warmed air and replacement by cooler air from above results in vertical mixing of the air column.

If, however, the air near ground level becomes colder (and thus denser) than the higher air masses, this vertical mixing ceases and a temperature inversion is formed -- air temperature increased with altitude. Without vertical mixing, the dispersion of pollutants is reduced and the build-up of ambient concentrations may occur.

An inversion can form under a wide variety of circumstances. In mountainous areas, downslope movements of dense, cold air from higher elevations can create an inversion condition in valley areas. Inversions readily occur in Truckee Meadows in the morning due to these cold drainage winds.

Temperature inversions can form at ground level or at various altitudes above the land surface. Both surface and elevated inversion layers may be present simultaneously. Surface inversions tend to break up with normal daytime heating of the land while inversions aloft tend to be more persistent. The "magnitude" or strength of an inversion is indicated by the temperature difference between the base and the top of the inversion layer. The layer of air between ground level and the base of an inversion is called the "mixing layer".

Vertical temperature profile data were unavailable prior to a special study in 1974 (AeroVironment, 1976). As indicated in Table B-2, surface-based inversions occurred during 88 percent of the soundings. This is a contrast to 1 out of 71 (1.4 percent) of the afternoon soundings exhibiting a ground level inversion. In addition to vertical temperature profiles taken by aircraft, acoustical radar was used to continuously monitor the vertical temperature structure. Data from these radar soundings indicate that inversions aloft occur often in the winter months (AeroVironment, 1976).

As stated previously, the strength of an inversion is indicated by the temperature difference between the base and the top of the inversion layer. The change in temperature per a unit vertical distance is also a method of indicating the strength of an inversion. A "normal" vertical temperature gradient is -1°C/100 meters (the dry adiabatic lapse rate). The strengths of morning surface-based inversions recorded during the AeroVironment (1976) study are presented below:

Time Period	Vertical Temperature Gradient	Range
Dec-Feb	+1.1°C/100m	-0.4 to -2.1°C/100m
Mar-May	+1.2°C/100m	-0.5 to -2.8°C/100m
Jun-Aug	+1.3°C/100m	-0.3 to -2.0°C/100m
Sep-Nov	+1.4°C/100m	0 to -2.6°C/100m

These data indicate a slight increase in inversion strength from winter to fall. Also, variations in these lapse rates are greatest in the fall.

Table B-2. Summary of Temperature Sounding Statistics Taken Over the Reno International Airport

	A.M.				P.M.			
Month/Year	No. of Soundings	No. of Surface-based Inversions	Stability Above Inversion		No. of Soundings	No. of Surface-based Inversions	Stability Above Inversion	
			Neutral	Stable			Neutral	Stable
Oct 1974	7	5	0	5	8	1	0	1
Nov	9	8	1	7	10	0	0	0
Dec	7	6	1	5	8	0	0	0
Jan 1975	7	7	2	5	7	0	0	0
Feb	5	4	0	4	9	0	0	0
Mar	3	1	0	1	1	0	0	0
Apr	5	4	0	4	4	0	0	0
May	5	5	0	5	5	0	0	0
Jun	1	1	0	1	2	0	0	0
Jul	9	9	0	9	7	0	0	0
Aug	8	8	0	8	10	0	0	0
Total	66	58	4	54	71	1	0	1

SOURCE: AeroVironment, 1976.

Meteorologic Conditions Favorable to Pollutant Episodes

Carbon Monoxide. Since carbon monoxide is an inert air pollutant, ambient concentrations are primarily influenced by the quantity of emissions and the dispersion of these emissions. Accordingly, conditions limiting the dispersion of carbon monoxide are favorable to increased ambient concentrations. These conditions include low wind speeds and low mixing heights. Inversion conditions, which readily occur in Truckee Meadows, limit the mixing height and therefore are conducive to the buildup of ambient concentration of carbon monoxide. These conditions readily occur in the winter months.

Ozone. Conditions favorable to increased ambient concentrations of ozone are low mixing heights, low to moderate wind speeds, and intense sunlight. Stagnant high pressure systems over an area can lead to a subsidence inversion; this condition is particularly conducive to ozone episodes. Typically, receptors downwind of major pollutant sources receive the largest dose of photochemical smog since the complex series of reactions involved in the formation of smog require a period of irradiation.

Particulates. Meteorologic conditions favorable to the buildup of ambient levels of particulate matter depend largely upon the source of emissions. Natural sources are stimulated by high wind speeds, since windblown dust is the primary source of natural particulate emissions. The type of soil, vegetation cover, and moisture content of soil markedly affect the wind erodibility of a given area. Once particulate matter is entrained in the atmosphere, low winds can contribute to increased ambient levels since dispersion would be reduced. This holds true for anthropogenic sources also, although the emission sources are different. Fugitive dust categories, such as construction, auto traffic on paved and unpaved roads, and agriculture activities, are related to man's activities and wind. High concentrations in Truckee Meadows are usually on days with extended periods of calm winds (PEDCo Environmental, Inc., 1977). This supports the theory that anthropogenic sources are large source of particulates in Truckee Meadows.

It is thus difficult to pinpoint meteorologic parameters that are favorable to the buildup of ambient levels of particulates, since emission sources are so important in the resultant ambient concentration.

Air Quality Monitoring

The location of the WCDHD's air quality monitoring stations are presented in Figure B-1. Monitoring data from these stations are presented in Tables B-3 through B-8. Additional data are contained in Appendix D of the Truckee Meadows AQIP (WCOG, 1978a).

Air Quality Trends in Truckee Meadows

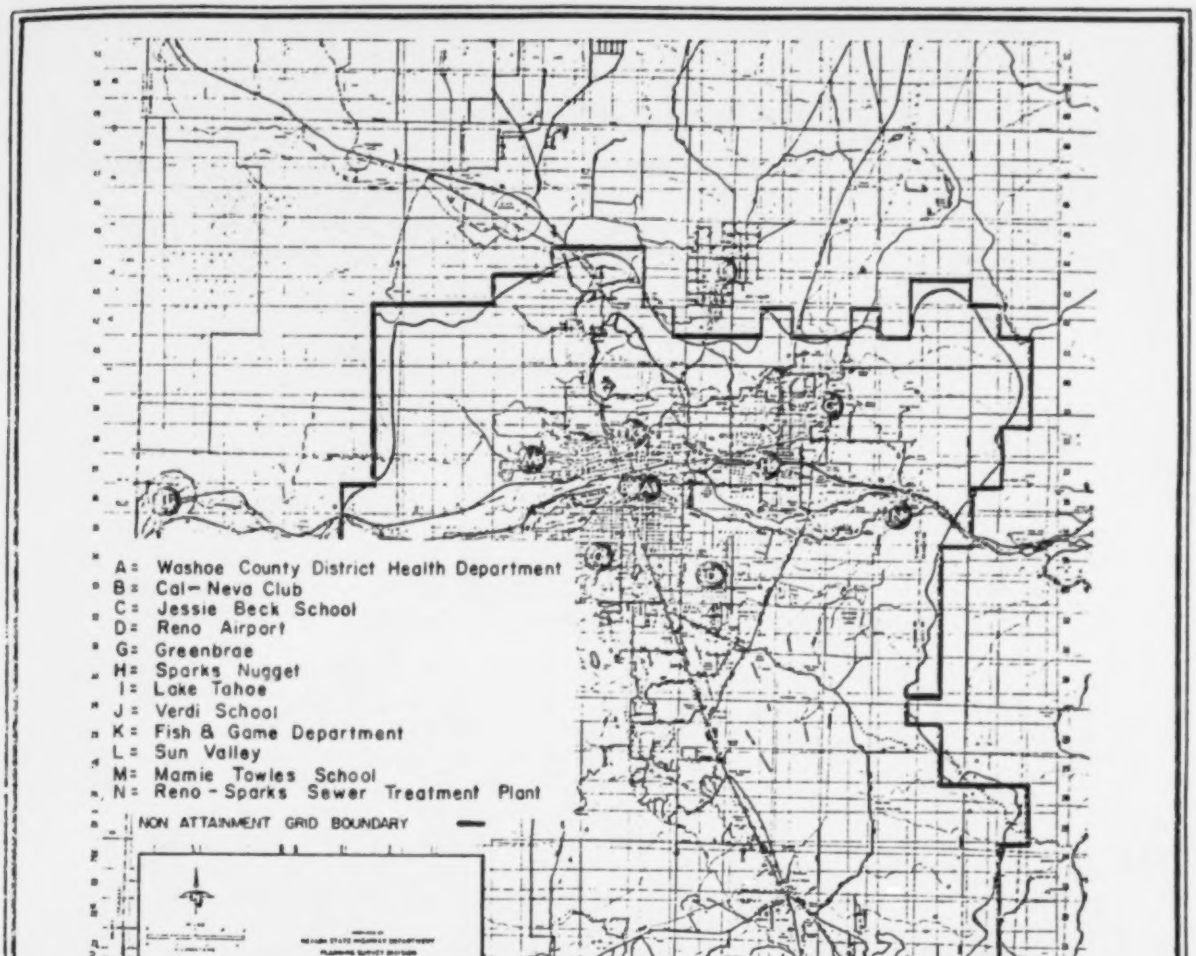
Ozone (O_3)

In general, ozone concentrations in Truckee Meadows have increased since monitoring was initiated in 1973. Both the peak hourly values and the number of violations of the NAAQS have increased over time, although 1976 was a relatively good year with respect to the number of violations recorded.

A special study conducted in 1974 and 1975 (AeroVironment, 1976) concluded that the downtown Reno station does not necessarily record the maximum ozone concentration in Truckee Meadows. At a site located about 8 miles west of downtown, a maximum hourly ozone concentration of 0.165 ppm was recorded. This is in contrast to a maximum hourly concentration of 0.096 ppm recorded at the downtown station during the same time period. It appears that the downtown station does not accurately reflect the levels of ozone that receptors are exposed to in outlying areas. A possible explanation of this observation is that nitric oxide (NO) emissions from vehicles in the downtown area are scavenging ozone. This explanation is consistent with observations from monitoring networks in large metropolitan areas such as Los Angeles. Maximum concentrations of ozone are typically found not in the downtown area, but rather in outlying areas downward of the central business area.

Recognizing this and other types of problems in monitoring station placement, EPA has recently adopted regulations that establish criteria for placement of monitoring stations (EPA, 1979). The WCDHD may be required to place an ozone monitor in an area representative of maximum concentrations.

Figure B-1



Air Quality Monitoring Sites
Washoe County District Health Department

A= Washoe County District Health Department
B= Cal-Neva Club
C= Jessie Beck School
D= Reno Airport
G= Greenbrae
H= Sparks Nugget
I= Lake Tahoe
J= Verdi School
K= Fish & Game Department
L= Sun Valley
M= Mamie Towles School
N= Reno-Sparks Sewer Treatment Plant
NON ATTAINMENT GRID BOUNDARY

Table B-3. Ozone Monitoring Data Monthly 1-hour Maximum (ppm)
Downtown Reno Site (Evans and Plaza Streets)

	1973	1974	1975	1976	1977	1978	1979	1980
January	0.014	0.020	0.018	0.054	0.049	0.056	0.064	0.043
February	0.026	0.015	0.026	0.060	0.059	0.063	0.049	0.048
March	0.021	0.018	0.017	0.048	0.061	0.070	0.059	0.062
April	0.033	0.022	0.017	0.052	0.075	0.058	0.059	0.073
May	0.040	0.028	0.028	0.060	0.075	0.098	0.084	0.069
June	0.036	0.036	0.026	0.075	0.090	0.088	0.082	
July	0.060	0.030	0.030	0.074	0.105	0.127	0.095	
August	0.053	0.022	0.054	0.072	0.145	0.115	0.094	
September	0.050	0.027	0.096	0.075	0.095	0.072	0.091	
October	0.030	0.019	0.087	0.095	0.088	0.071	0.086	
November	0.012	0.014	0.040	0.060	0.062	0.070	0.050	
December	0.012	0.010	0.060	0.045	0.046	0.075	0.053	
Annual	0.060	0.036	0.096	0.095	0.145	0.127	0.095	

SOURCE: Washoe County District Health Department.

Table B-4. Monthly Maximum 8-hour Average CO Concentrations (ppm)
(Reno Monitoring Station)

	1973	1974	1975	1976	1977	1978	1979	1980
January	12.0	12.6	13.7	10.9	12.8	10.6	*	
February	18.3	9.3	13.2	9.3	10.6	*	*	
March	9.6	6.9	5.9	5.8	7.8	*	*	
April	12.4	4.8	5.4	4.3	5.4	*	*	
May	10.0	4.2	4.6	3.9	3.6	*	*	
June	12.3	4.3	4.5	3.4	2.9	*	*	
July	11.6	2.7	3.1	4.8	3.0	*	*	
August	7.7	3.7	4.4	3.7	4.9	*	*	
September	6.7	9.2	7.3	5.7	5.0	*	*	
October	8.2	9.5	8.3	12.3	13.4	9.1	*	
November	7.9	9.6	9.7	12.6	10.4	10.3	10.8	
December	11.8	11.1	13.1	13.9	15.2	17.3	20.9	

SOURCE: Washoe County District Health Department.

*The Washoe County District Health Department does not calculate the 8-hour average unless a violation occurs.

Table B-5. Number of Exceedences of 9 ppm 8-hour CO Standard

	1973	1974	1975	1976	1977	1978	1979	1980
January	6	3	10	4	4	2	5	4
February	2	1	2	1	2	0	8	0
March	0	0	0	0	0	0	0	0
April	5	0	0	0	0	0	0	0
May	3	0	0	0	0	0	0	0
June	6	0	0	0	0	0	0	
July	3	0	0	0	0	0	0	
August	0	0	0	0	0	0	0	
September	0	1	0	0	0	0	0	
October	0	2	0	1	3	1	0	
November	0	2	1	1	3	2	2	
December	6	6	8	14	10	21	13	
TOTAL	31	15	21	21	22	26	28	

SOURCE: Washoe County District Health Department.

Table B-6. Carbon Monoxide Monitoring Data
Monthly 1-hour Maximum (ppm)

	1973	1974	1975	1976	1977	1978	1979	1980
January	24.0	18.7	23.6	18.5	16.0	18.0	15.6	14.4
February	20.0	14.7	16.1	15.5	14.5	14.0	17.0	12.3
March	12.0	11.7	11.1	8.0	10.0	8.0	8.7	9.1
April	15.0	8.3	7.3	5.5	6.0	5.2	5.9	5.8
May	12.0	6.8	7.3	7.5	5.5	7.0	8.1	5.1
June	14.0	6.8	5.3	5.0	4.9	5.0	5.6	
July	16.0	4.8	5.4	5.7	5.5	5.4	5.6	
August	15.5	5.8	7.9	8.0	7.0	8.5	7.3	
September	14.5	12.8	11.4	11.0	8.5	8.5	11.0	
October	18.7	12.7	13.8	22.0	18.5	17.6	14.8	
November	16.7	19.7	15.8	21.5	15.5	14.3	16.4	
December	18.7	17.7	23.3	22.0	24.5	21.5	34.2	
Annual	24.0	19.7	23.6	22.0	24.5	21.5	34.2	

SOURCE: Washoe County District Health Department.

Table B-7. Total Suspended Particulates-
Annual Geometric Means ($\mu g/m^3$)

	Airport	Beck School	Cal-Neva	Health Dept.	Sparks Nugget	Greenbrae	Fish & Game	Towles School	Sewage Treatment Plant
1973	64.3	49.8	97.8	89.2	90.5	64.4	ND	ND	ND
1974	65.8	46.6	76.2	74.4	94.1	70.0	85.5*	ND	58.6*
1975	63.7	42.4	73.8	77.3	93.1	56.7	54.1	35.4*	48.0
1976	61.1	45.3	84.2	77.4	100.2	66.7	66.1	48.3	43.1
1977	74.2	48.1	97.1	75.0	123.3	70.1	71.8	52.0	52.2
1978	83.3	45.9	85.5	84.5	111.1	64.0	72.1	54.7	46.3
1979	153.0	55.3	86.2	83.4	111.5	73.6	68.8	51.2	83.1
1980									

NOTES:

ND = no data
*value based on incomplete data record

SOURCE: Washoe County District Health Department.

Table B-8. Total Suspended Particulates-Number of Exceedences of 24-hour 260 $\mu g/m^3$ Standard

	Airport	Beck School	Cal-Neva	Health Dept.	Sparks Nugget	Greenbrae	Fish & Game	Towles School	Sewage Treatment Plant
1973	0	0	1	1	0	0	-	-	-
1974	0	0	0	0	1	1	0*	-	0*
1975	0	0	0	0	1	0	0	0	0
1976	0	0	1	1	4	1	1	0	0
1977	0	0	0	1	1	1	0	0	0
1978	0	0	1	1	0	0	1	1	0
1979	3	0	0	1	1	1	0	0	1
1980									

*partial data.

SOURCE: Washoe County District Health Department.

Carbon Monoxide (CO)

No violations of the 1-hour NAAQS for carbon monoxide have been recorded in Truckee Meadows. The 8-hour NAAQS, however, is frequently violated in the winter months. Although the number of violations of the 8-hour NAAQS have remained relatively constant, the peak 8-hour values have steadily increased since 1974 (Table B-4).

Total Suspended Particulates (TSP)

Both the 24-hour and annual geometric mean TSP NAAQS are regularly violated in Truckee Meadows, primarily in winter months. Concentrations in the air basin are quite variable; elevated levels are localized in nature. Violations of the annual TSP NAAQS occur primarily at the Cal-Neva Club, WCDHD, and the Sparks Nugget stations (see Figure B-1). Violation of the 24-hour NAAQS at the MGM site (established in 1976) is attributed to construction of the MGM Hotel and Highway 395 (WCOG, 1978). Upon completion of the MGM Grand Hotel, TSP concentrations were reduced significantly.

An increasing percentage of TSP monitoring stations within Truckee Meadows are violating the 75 $\mu g/m^3$ NAAQS.

Summary of Truckee Meadows Air Quality Implementation Plan (AQIP)

Introduction

The Truckee Meadows AQIP (WCOG, 1978) is essentially divided into three main sections. The first section contains emissions forecasts for the Truckee Meadows in future years. The level of emissions that will lead to attainment of NAAQS is also determined in this section. The second section evaluates various control strategies based on their effectiveness in reducing emissions and economic, social and environmental criteria. The last section discusses how the measures will be implemented and the planning process involved in the AQIP. The following discussion summarizes these three main sections.

Emission Forecasts

Emissions forecasts contained in the AQIP are based on the year 1977 emissions inventory and growth factors for 1982 and 1987. Two growth indicators are the basis for determining future emissions for the majority of source categories: population forecasts and projections of vehicle usage.

Population forecasts used in the AQIP were developed by the Bureau of Business and Economic Research (BBER), University of Nevada, Reno (for discussion of population forecasts, see Appendix A). Estimates of vehicle usage (expressed as vehicle miles travelled [VMT]) were developed by the Regional Transportation Commission, and are partially based on the BBER population forecast.

The base year (1977) emission inventory is presented in Table 4-38 of the EIS text. Except for TSP, mobile sources account for the majority of pollutant emissions in Truckee Meadows. Fugitive dust categories account for 94 percent of TSP emissions, while sulfur oxide emissions are minute. Figure 4-36 of the EIS text depicts the relative contribution of source categories for CO, TSP, and total hydrocarbons (THC) emissions in 1977.

Emissions forecasts for years 1982 and 1987 were calculated for CO, HC, and TSP since only these pollutants currently violate NAAQS (HC are precursors to ozone) (Tables B-9 and B-10). Similar to the 1977 inventory, mobile sources account for the majority of CO and HC emissions, while fugitive dust categories account for 94 percent of TSP emissions for the 1982 and 1987 inventories.

Table B-9

1987 TRUCKEE MEADOWS AIR BASIN
BASELINE EMISSIONS INVENTORY

Pollutant Source	Pollutant Emissions (Tons/Yr)		
	CO	THC	TSP
STATIONARY SOURCES			
1. Petroleum Storage	-	633	-
2. Gasoline Dispensing	-	1,302	-
3. Paint (Structures & Misc)	-	112	-
4. Paint (Autos)	-	54	-
5. Dry Cleaning	-	139	-
6. Degreasing	-	48	-
7. Oil Used as Carrier for Pesticides	-	0	-
8. Cement Processing	-	-	2
9. Asphalt Batching	-	-	4
10. Asphalt Paving	-	276	-
11. Natural Gas Combustion (Residential/Space Heating)	72	29	37
12. Natural Gas Combustion (Commercial Processes)	18	3	10
13. Light Fuel Oil Combustion	63	13	31
14. Residual Fuel Oil Combustion	5	1	8
15. LPG Combustion	6	1	6
16. Coal Combustion	23	5	5
17. Fireplaces	5,127	213	863
18. Incinerators	28	9	19
19. Permitted Fires	1	-	1
20. Structural Fires	12	4	1
21. Wild Fires	3	-	0
Subtotal for Stationary Sources	(5,358)	(2,842)	(987)
MOBILE SOURCES			
22. Motor Vehicles	27,122	2,685	154
23. Off-Road RV's	1,634	100	3
24. Construction Equipment	261	84	22
25. Railroads	175	125	33
26. Aircraft	1,706	559	24
Subtotal for Mobile Sources	(30,898)	(3,553)	(236)
FUGITIVE DUST			
27. Residential Construction	-	-	2,624
28. Commercial Construction	-	-	8,434
29. Paved Streets	-	-	6,896
30. Unpaved Roads	-	-	946
31. Street Sanding (Red Cinder)	-	-	202
32. Street Sanding (Sand)	-	-	429
33. Sand and Gravel Pits (Active)	-	-	464
34. Sand and Gravel Pits (Inactive)	-	-	-
35. Agriculture	-	-	29
36. Cleared Area	-	-	38
37. Playgrounds	-	-	74
38. Unpaved Parking Lots	-	-	27
39. Railroad Right-of-Way	-	-	36
40. Heavy Equipment Storage	-	-	3
41. Unpaved Road Shoulders	-	-	2
42. Horse Corrals	-	-	9
Subtotal for Fugitive Dust	-	-	(20,213)
TOTAL	(36,250)	(6,395)	(21,436)

SOURCE: WCOG, 1978.

Table B-10

1982 TRUCKEE MEADOWS AIR ABSIN
BASELINE EMISSIONS INVENTORY

Pollutant Source	Pollutant Emissions (Tons/Yr) CO	THC	TSP
STATIONARY SOURCES			
1. Petroleum Storage	-	502	-
2. Gasoline Dispensing	-	1,031	-
3. Paint (Structures & Misc)	-	100	-
4. Paint (Autos)	-	48	-
5. Dry Cleaning	-	123	-
6. Degreasing	-	38	-
7. Oil Used as Carrier for Pesticides	-	0	-
8. Cement Processing	-	-	2
9. Asphalt Batching	-	-	4
10. Asphalt Paving	-	245	-
11. Natural Gas Combustion (Residential/Space Heating)	63	26	32
12. Natural Gas Combustion (Commercial Processes)	16	3	9
13. Light Fuel Oil Combustion	56	12	27
14. Residual Fuel Oil Combustion	5	1	8
15. LPG Combustion	5	1	5
16. Coal Combustion	23	5	5
17. Fireplaces	4,551	189	766
18. Incinerators	28	9	19
19. Permitted Fires	2	-	1
20. Structural Fires	10	4	1
21. Wild Fires	3	-	0
Subtotal for Stationary Sources	(4,762)	(2,337)	(879)
MOBILE SOURCES			
22. Motor Vehicles	40,915	4,453	231
23. Off-Road RV's	2,465	150	4
24. Construction Equipment	266	86	33
25. Railroads	159	113	30
26. Aircraft	1,401	459	20
Subtotal for Mobile Sources	(45,206)	(5,261)	(318)
FUGITIVE DUST			
27. Residential Construction	-	-	2,637
28. Commercial Construction	-	-	8,478
29. Paved Streets	-	-	5,462
30. Unpaved Roads	-	-	1,066
31. Street Sanding (Red Cinder)	-	-	192
32. Street Sanding (Sand)	-	-	408
33. Sand and Gravel Pits (Active)	-	-	464
34. Sand and Gravel Pits (Inactive)	-	-	-
35. Agriculture	-	-	33
36. Cleared Area	-	-	39
37. Playgrounds	-	-	66
38. Unpaved Parking Lots	-	-	30
39. Railroad Right-of-Way	-	-	36
40. Heavy Equipment Storage	-	-	3
41. Unpaved Road Shoulders	-	-	2
42. Horse Corrals	-	-	9
Subtotal for Fugitive Dust	-	-	(18,925)
TOTAL	(49,968)	(7,598)	(20,122)

SOURCE: WCOG, 1978.

Allowable Emissions. In order to determine the quantity of emissions that will lead to attainment of the NAAQS for O_3, CO, and TSP, the emissions inventory is related to ambient concentrations through a technique known as the rollback equation.

The forecast of ambient air quality using the rollback technique is based on the assumption that changes in ambient concentrations are proportional to changes in total emissions. This proportionality is usually assumed to be direct and linear. The major advantage of the rollback approach over complex simulation models is that the only data needed are ambient concentrations and pollutant emissions. The mechanism by which emissions become transformed into observed ambient air quality is not of direct concern. Historical data (emission estimates and monitored ambient air quality) serve as a guide to the net result of the mechanisms actually involved. The basic rollback equation is as follows:

$$A_f = A_b \times \frac{E_f}{E_b}$$

where: A_f = future ambient air quality
A_b = base year ambient air quality
E_f = future emissions
E_b = base year emissions

This formula can be modified to account for background concentrations and pollutant transport, but the basic assumptions and form of the equation remain the same.

Through the use of the rollback equation, the quantity of emissions that will lead to acceptable ambient concentrations can be determined. In the Truckee Meadows AQIP, the base year 1977 emissions inventory and historical monitoring data for 1975 through 1977 were used as inputs to the rollback equation. The second highest observed ambient concentrations for CO and O_3 are used as representative ambient monitoring data. For TSP, the highest annual geometric mean recorded in the air basin is taken as representative data. These values are known as the design values.

Referring back to the rollback equation, it is clear that if one has values for three out of the four variables, the fourth can be determined. This is essentially how allowable emissions were determined in the AQIP.

The determination of allowable emissions as presented in the AQIP are discussed for each pollutant below.

Ozone. O_3 is the product of a large number of interrelated chemical reactions involving nitrogen oxides, oxygen, water vapor and numerous organic gases (hydrocarbons). The reaction sequence is activated by sunlight, hence the name photochemical smog. O_3 is a secondary pollutant; that is, it is not directly emitted into the atmosphere. Control strategies must, therefore, be directed toward the precursor pollutants which react under sunlight to produce O_3. Control strategies to reduce O_3 levels are directed toward HC emission reductions.

The design value for O_3 (the second highest maximum one-hour O_3 concentration) used in the Truckee Meadows AQIP is 0.125 ppm. In order to determine the level of reduction in HC emissions, the Empirical Kinetic Modelling approach (EKMA) was used. This approach graphically relates NO_X and HC concentrations to resultant O_3 concentrations at a fixed HC to NO_X ratio (in this case 9.5:1). Utilizing EKMA, the level of reduction (expressed as a percentage of hydrocarbon emissions) is applied to the base year emissions inventory. In addition, the assumed five percent natural background level of HC is taken into account. In a revision to the AQIP, the allowable percentage of base year HC emissions was determined to be 88. Thus, the emission goal is 88 percent of 9,841 tons, or 8,700 tons (see Table B-11). For a more complete explanation of how EKMA is used, the reader is referred to the AQIP (WCOG, 1978).

Carbon Monoxide. A revision to the Truckee Meadows AQIP has identified the second highest eight-hour average CO concentration as 15.1 ppm (Wiel, memorandum). The 16.0 ppm value used in the original AQIP was found to be in error. Using this new design value, the allowable percentage of base year carbon monoxide emissions was found to be 60. Thus, the emission goal is 60 percent of 74,119 tons, or 44,200 tons per year (Table B-11).

Total Suspended Particulates. Using a design value of 123.3 $\mu g/m^3$ (annual geometric mean) and a natural background concentration of 25 $\mu g/m3$, allowable particulate emissions were determined to be 10,000 tons per year or 51 percent of the base year emissions (19,668 tons).

Control Strategy Evaluation

A screening analysis was utilized to evaluate the candidate control strategies presented in the AQIP. These screening criteria include:

- implementing agency
- funding source
- annualized cost

Table B-11. Summary of Emissions and Level of Control Needed to Attain NAAQS

Year	Emissions - Tons/Year THC	CO	TSP
1977			
Stationary Sources	1,890	3,690	680
Mobile Sources	7,950	70,430	470
Fugitive Dust	-	-	18,520
Total	9,840	74,120	19,670
1982[1]			
Stationary Sources	2,340	4,760	880
Mobile Sources	5,580	52,360	320
Fugitive Dust	-	-	18,920
Total	7,600	57,120	20,120
1987[1]			
Stationary Sources	2,840	5,360	990
Mobile Sources	4,090	36,340	240
Fugitive Dust	-	-	20,210
Total	6,930	41,700	21,440
Allowable Emissions to Meet Primary NAAQS	8,700	44,200	10,000
Percent Reduction Needed to Attain NAAQS			
1982	0	23	50
1987	0	0	53

[1] The original AQIP presumed an I/M program implemented fully in 1979. The revised calculations assume no I/M program.

SOURCE: WCOG, 1978; Wiel, pers. comm., memorandum.

- potential emission reduction
- cost effectiveness (dollars/ton)
- economic impacts
- social impacts
- environmental impacts
- feasibility

Through the use of these screening criteria, candidate control strategies that were judged inappropriate were eliminated from further consideration.

Since mobile sources account for the majority of CO emissions within Truckee Meadows, control strategies for this pollutant focused on transportation-related measures (Table B-12).

Control strategies for HC (precursor to O_3) focus on the same transportation sources addressed for CO control, as well as sources of vaporization of various fuels and solvents during handling and storage (Table B-12).

Since 94 percent of particulate emissions in Truckee Meadows come from fugitive dust sources (construction activities, dust resuspension from vehicular traffic on unpaved and paved roads, etc.), control strategies focus on these sources of emissions (Table B-12).

Implementation of Plan

Adoption of recommended control strategies is required by the appropriate state and local governmental agencies in order for the AQIP to satisfy the Clean Air Act Amendments of 1977. In addition, "reasonable further progress" must be demonstrated each year toward the attainment of NAAQS.

The Intergovernmental Air Quality Task Force and WCOG are responsible for monitoring implementation of the AQIP and coordinating the Truckee Meadows air pollution planning effort. The Task Force will annually review and revise as necessary the AQIP in order to attain the NAAQS as required by the Clean Air Act Amendments of 1977.

Implementation of the recommended control strategies will lead to attainment of NAAQS for TSP and CO in 1982 and 1987, respectively. The WCOG Air Quality Task Force will be requesting a 5-year extension for the attainment of the eight-hour CO NAAQS since adopted control strategies are not sufficient to meet the 1982 deadline.

Table B-12. Control Strategy Emission Reductions as Presented in the AQIP

	Emission Reductions, Tons/Year					
	1982			1987		
Control Measure	CO	THC	TSP	CO	THC	TSP
Road Improvement	530	55	-	870	84	-
Traffic Control	820	89	-	540	54	-
Ride Sharing	4,520	480	-	2,980	290	-
RACT Measures[1]	-	810	-	-	910	-
Construction Dust Control	-	-	4,750	-	-	5,480
Pave Surfaces	-	-	1,066	-	-	946
Street Sweeping	-	-	3,660	-	-	3,660
TOTALS	5,870[2]	1,434[3]	9,476	4,390	1,338[4]	10,086

[1] RACT measures are reasonably available control technology measures applicable to volatile hydrocarbon emissions.

[2] Of the total potential of 5,870 tons per year, 4,700 are committed to in the AQIP.

[3] Of the total potential of 1,434 tons per year, 1,147 tons or 80 percent are committed to in the AQIP.

[4] Of the total potential of 1,338 tons per year, 1,070 tons or 80 percent are committed to in the AQIP.

SOURCE: WCOG, 1978; Wiel, pers. comm., memorandum.

As noted previously, the WCOG Task Force has requested a reclassification for O_3 from nonattainment to unclassifiable due to the change in the NAAQS for O_3. Ambient air quality monitoring data indicate that concentrations of O_3 are not in violation of the new 0.12 ppm O_3 NAAQS, although concentrations were in violation of the old 0.08 ppm standard.

All of the control strategies listed in Table B-12 are currently being implemented.

Current Air Quality Management Programs

Air quality management responsibilities exist at local, state, and federal levels of government. The following discussion focuses on air quality management programs in Nevada and at the federal level.

Nevada legislation enacted in 1969 authorized the State Environmental Commission Policy Board to adopt rules and regulations to control air pollution, adopt air quality standards, establish motor vehicle emission standards, establish emission control requirements, monitor pollutants, and delegate authority to local agencies. The Nevada Department of Conservation and Natural Resources is the air pollution control agency of the state.

Motor vehicle emission standards are enforced by the Department of Motor Vehicles.

The State Environmental Commission authorized the District Health Departments of Washoe and Clark Counties to establish local air pollution programs. The remainder of counties are regulated by the NDEP.

Federal and state activities related to air quality have been authorized by several pieces of legislation, the most important of which are the 1970 and 1977 Amendments to the Clean Air Act. The 1970 Clean Air Act amendments set the basic structure for federal and state air pollution control programs. This basic structure has been retained under the 1977 Clean Air Act Amendments. Under the 1970 amendments, the air pollution control activities of the federal government were transferred to EPA. Among other things, EPA was directed to conduct various research programs; to provide financial assistance to state and local air pollution control agencies; to establish air quality control regions for purposes of air quality management; to establish national ambient air quality standards; and to establish emission standards for various stationary and mobile sources of air pollutants.

The 1970 Clean Air Act Amendments required each state to develop and adopt a plan (implementation plan) to achieve, maintain and enforce the national primary and secondary ambient air quality standards in all portions of the state. The 1970 amendments further required that these implementation plans provide the means for achieving and maintaining all national primary standards by July 1975 and all national secondary standards "within a reasonable time". EPA was granted the authority to approve or disapprove these plans, and to promulgate an acceptable plan if all or a portion of the submitted plan was disapproved. EPA was also given the authority to grant time extensions of up to two years for the attainment of a national primary ambient air quality standard in any particular air quality control region.

The 1977 Clean Air Act Amendments recognized the fact that most of the major urban regions of the country failed to attain the national primary air quality standards within the deadlines set by the 1970 Clean Air Act Amendments. The new amendments required the states and EPA to identify areas which meet all federal air quality standards; areas which exceed any of the federal standards; and areas where adequate ambient air quality monitoring data are lacking. Truckee Meadows has been designated a "nonattainment area" with respect to TSP and CO, an "attainment area" for sulfur dioxide and nitrogen dioxide, and "unclassified" for O_3.

The 1977 amendments to the Clean Air Act establish numerous criteria for determining the adequacy of state implementation plans. Some of the more significant of these include the following requirements:

- The implementation plan must include special provisions for areas designated as nonattainment areas. Plans for nonattainment areas must provide a means of achieving the federal primary standards as expeditiously as possible, but not later than December 31, 1982.

- If an area is designated as a nonattainment area with respect to oxidants or carbon monoxide, the deadline for achieving the federal air quality standard can be extended by up to five years (to December 31, 1987) provided a number of specified conditions are met.

- The implementation plan must include schedules and timetables for implementing emission limitations, transportation controls, air quality maintenance plans, preconstruction review of direct sources of pollution, and other measures necessary to ensure attainment and maintenance of the federal primary and secondary air quality standards.

- State implementation plans for nonattainment areas must provide for installation of "reasonably available control technology" on existing stationary sources.

- Plans for nonattainment areas must provide a means of achieving annual incremental reductions in the emissions of relevant pollutants so as to attain the federal air quality standards by the target date identified in the plan ("reasonable further progress" requirement).

- Plans for nonattainment areas must expressly identify and quantify pollutant emissions which will be allowed to result from the construction and operation of major new or modified stationary sources in the nonattainment area.

- The implementation plan must prohibit construction or modification of major stationary sources in nonattainment areas after June 30, 1979 if the state has failed to submit to EPA acceptable implementation plan revisions pertaining to that nonattainment area.

The 1977 Clean Air Act Amendments indicate that implementation plan provisions for oxidant and carbon monoxide nonattainment areas should be prepared by an appropriate organization of local government officials, as designated by the state. The NDEP has designated the WCOG as lead agency for developing O_3, CO, and TSP control strategies for the Truckee Meadows nonattainment area.

The 1977 Clean Air Act Amendments contain several provisions regarding federal permit activities or financial assistance programs. These provisions can be summarized as follows:

- After July 1, 1979 EPA is prohibited from awarding any grants authorized under the Clean Air Act, except for air quality improvement or maintenance purposes, if the agency applying for the grant is in an air quality control region where the following three conditions apply: one or more federal primary standards have not been attained; transportation control measures are necessary to achieve the standard being violated; and an appropriate state implementation plan has not been submitted (or reasonable efforts toward developing such a plan are not being made). This funding prohibition also applies if an approved plan is not being implemented.

- After July 1, 1979 the U. S. Department of Transportation is prohibited from awarding grants of approving projects under Title 23, United States Code, except for safety, mass transit, or transportation projects which improve air quality, if the agency applying for the grant funds or project approval is in an air quality control region where the three conditions cited above apply. This funding prohibition also applies if an approved plan is not being implemented.

- No federal agency can engage in, license, permit, approve, or support in any way any activity which does not conform to the approved or promulgated state implementation plan for the relevant area.

- EPA is authorized to withhold, condition, or restrict any grant for construction of sewage treatment facilities if it is determined that: (a) such sewage treatment facilities will not comply with Clean Air Act provisions relating to new source performance standards or emission standards for hazardous air pollutants; (b) the state does not have, or is not implementing, an approved state implementation plan which expressly quantifies and provides necessary management programs to deal with the air pollutant emissions which may reasonably be anticipated to result directly or indirectly from the new sewage treatment capacity to be created by such construction; (c) the construction of such treatment works would create new sewage treatment capacity which may reasonably be anticipated to cause or contribute to, directly or indirectly, a larger increase in pollutant emissions than has been provided for under the applicable state implementation plan; or (d) the construction of such treatment works would create new sewage treatment capacity which would cause or contribute to, directly or indirectly, an increase in pollutant emissions which will interfere with or be inconsistent with the applicable implementation plan of any other state.

Fireplace and Wood Stove Emissions in Truckee Meadows

The spiraling cost of home space heating in recent years has prompted many people to supplement home space heating with the use of fireplaces and wood stoves. Because fireplaces and wood stoves are generally extremely inefficient combustion devices, significant quantities of air pollutants are produced. The major pollutants of concern are unburned combustibles - carbon monoxide and smoke. A major question with respect to fireplaces and wood stoves is whether the increased use of these will significantly impact the air quality of Truckee Meadows. The purpose of this discussion is to raise the issue and to suggest that fireplaces and wood stoves do significantly impact the air quality of Truckee Meadows.

CO problems are associated with areas of high emission density (emissions per unit area) such as high volume traffic arteries and parking lots. Even though widely dispersed, high emission rates from fireplaces and wood stoves may at times lead to significant emission densities, especially when one considers their widespread use. In contrast, natural gas and fuel oil furnaces exhibit much lower emission rates, thus these space heating systems seldom produce a significant contribution to CO problems.

TSP problems are typically associated with areawide emission sources, dominated by fugitive dust sources. These sources include construction activities, vehicle traffic on paved and unpaved roads, and wind erosion on cleared areas. Particulate emissions from fireplaces are also an areawide source, and may significantly affect ambient concentrations of particulates.

Until recently, there has not been a great deal of interest in the quantification and characterization of gaseous emissions from fireplaces and wood stoves. Three factors have prompted greater interest in this area: (1) an increase in the utilization of wood as a fuel, (2) greater environmental concerns, and (3) the identification of potentially hazardous compounds (e.g., polycyclic organic matter) in emissions from wood combustion.

Recent studies on fireplace and wood stove emissions (Butcher and Sorenson, 1979; Milliken, 1979; EPA, 1980) have found emissions to be substantial, especially on a "per Btu" basis. Emission factors (emissions per unit process) used in the development of emissions forecasts in the Truckee Meadows were taken from EPA (1977), commonly known as "AP-42", supplement 7. Results from Milliken (1979) and EPA (1980) indicate that the AP-42 emission factors for CO may have underestimated actual emissions (Table B-13). If this is the case, the relative contribution of fireplace emissions on ambient concentrations of CO have been underestimated in Truckee Meadows.

Another contributing factor to the possible underestimation of fireplace and wood stove emissions is the identification of the amount of wood burned in Truckee Meadows. It is possible that the average quantity of wood consumed per household is greater than that assumed in the AQIP forecasts. Acquiring reliable data on actual wood consumption for fireplace and wood stove use is difficult at best. More attention should be focused on this source category.

Table B-13. Summary of Results of Emissions From Fireplaces and Stoves

Source	Emissions (lbs/tons of fuel) TSP	CO	Type of Combustion Apparatus
EPA (1977)	20	120	Fireplace
Butcher and Sorenson (1979)	2-48	-	Wood Stoves
EPA (1980)	5.1-19[1]	22-80 166-740	Fireplace Wood Stove
Milliken (1979)	4-30	120-260	Fireplace and Wood Stove

[1] Emissions from both fireplaces and stoves. The mean for 12 test configurations equals 19.4 lbs/ton.

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Reno-Sparks Joint Water Pollution Control Plant Master Project

Draft Environmental Impact Statement

Appendix C

Institutional Constraints Affecting Water Rights in the Truckee River Basin

November 30, 1979

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List of Acronyms

AF	acre-feet
AWT	advanced wastewater treatment
BIA	U. S. Bureau of Indian Affairs
BLM	U. S. Bureau of Land Management
cfs	cubic feet per second
CTWCD	Carson-Truckee Water Conservancy District
DOI	U. S. Department of Interior
EIS	Environmental Impact Statement
EPA	U. S. Environmental Protection Agency
ESA	Endangered Species Act
ESC	Endangered Species Committee
ESP	Early Start Program
JWPCP	Reno-Sparks Joint Water Pollution Control Plant
M&I	municipal and industrial
NEPA	National Environmental Policy Act
SPPCo	Sierra Pacific Power Company
TCID	Truckee-Carson Irrigation District
TRA	Truckee River Agreement
USFWS	U. S. Fish and Wildlife Service
WCWCD	Washoe County Water Conservation District

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INSTITUTIONAL CONSTRAINTS AFFECTING WATER RIGHTS IN THE TRUCKEE RIVER BASIN

An EIS is required to contain, among other things, a "description of the environment" surrounding the proposed project and the "probable impact of the proposed action on the environment, "including secondary or indirect effects. (40 C.F.R. § 1500.8) These requirements refer not only to the physical and biological environment, but social, institutional, and legal factors as well.

In the case of the JWPCP expansion project, consideration of the legal and institutional aspects of the environment are especially important. The JWPCP is located on the Truckee River, a navigable interstate stream dotted with federal reclamation projects, privately-owned facilities, and thousands of individual water users. Water rights along the Truckee have been complicated by litigation since almost the turn of the century. The legal and institutional framework of water law and water rights in the area must be considered for any project affecting the Truckee River flows, as is proposed for some Master Project alternatives. The following report attempts to explain the water laws and water rights governing actions in the Truckee River Basin and the institutional constraints on Master Project alternatives.

Development of the Institutional Framework on the Truckee River

To provide a better understanding of some of the institutional constraints affecting the Master Project, a chronology of the development of the institutional framework on the Truckee River is presented below and summarized in Table C-1. Case briefs summarizing the major court cases and administrative agency hearings which impact water and water rights on the Truckee River are included in sub-Appendix C-1.

Physical Description and Early History of the Truckee Region (to mid-1800s)

The Truckee River originates in the Sierra Nevada Range at the outlet of Lake Tahoe in California and terminates at Pyramid Lake about 30 miles northeast of Reno, Nevada. As an interstate stream, it is subject to the water law regimes of both California and Nevada. In addition, the Truckee River is a navigable stream which contains several federal reclamation projects and federal land reservations. Thus, it is also subject to the full panoply of federal laws, including water quality regulation, reclamation law, and the law of federal reserved water rights. These legal constraints have developed incrementally over more than a century, creating a complex institutional structure which affects Truckee River water rights.

Historically, the entire natural flow of the Truckee River emptied into Pyramid Lake, a terminal desert lake with no other major inflow. As in any water-scarce region, the quantity of water in the river fluctuated with the amount of precipitation in any given year. The river's flow into Pyramid Lake probably ranged from as low as 250,000 acre-feet in dry years to over a million acre-feet in wet years. The river and the lake contained a large fishery of Lahontan cutthroat trout and cui-ui lake suckers. During some wet years, overflow from Pyramid Lake emptied into a playa called Winnemucca Lake and helped support populations of birds and wildlife. The area around the lake and along stretches of the Truckee was inhabited by the Paiute Indians, who obtained some of their sustenance from the fishery and wildlife.

In 1844, John C. Fremont explored the area and named Pyramid Lake. During the remainder of the 19th century, many white settlers moved into the region, creating settlements throughout the Truckee River watershed and diverting water for mining, agriculture and municipal and industrial purposes. Growing demands led to conflicts among the various users of the Truckee's waters. Much of the river's institutional history represents attempts at resolving these conflicts and allocating water among the competing users. The State of Nevada first enacted statutes concerning water rights in 1866, but the fledgling government could not keep up with the development boom, and state water law remained unclear into the 1900s.

Creation of the Pyramid Lake Paiute Indian Reservation (1859-1874)

On December 8, 1859, the lower 20 miles of the Truckee River and the area around and including Pyramid Lake were withdrawn from the public domain by the U. S. Commissioner of the General Land Office for an Indian reservation. The reservation was confirmed by President Grant's executive order in 1874. Several hundred Paiutes have occupied the reservation since 1859, obtaining their livelihood mainly by fishing, along with raising some crops and livestock.

Newlands Reclamation Project (1902-1915)

In June of 1902, Congress passed major legislation affecting the arid western states. The Reclamation Act of 1902 (33 Stat. 388) authorized federal irrigation projects for reclaiming arid land. The first project carried out under the Act was the Newlands Project on the Truckee and Carson Rivers in Nevada.

The Newlands Project was begun in 1905 and completed in 1915. It consisted mainly of the construction of Derby Dam and Truckee Canal on the Truckee River 20 miles below Reno. Water was diverted through the canal to an area about 33 miles southeast near the town of Fallon on the Carson River. The project was originally planned to irrigate over 300,000 acres, but it has never included more than 73,000 acres and it currently serves about 65,000 acres. The Newlands Project also encompasses Lahontan Reservoir on the Carson at the terminus of the Truckee Canal and the dam regulating the Truckee River at Lake Tahoe.

Early Litigation and Governmental Activities (1913-1950)

To ensure adequate supplies of water for the Newlands Project, the United States brought a quiet title action in 1913 against more than 800 other Truckee water users to adjudicate water rights in the Truckee Basin. (*United States v. Orr Ditch Water Company, et al.*, Equity No. A-3 [D. Nev. 1944]). In this action, the United States filed claims for water to irrigate lands within the Newlands Project and some lands on the Pyramid Lake Reservation. A final decree was not issued until 1944.

Meanwhile, the United States took other action concerning the Newlands Project. The government brought a condemnation action in 1909 against a power company, the predecessor of Sierra Pacific Power Company (SPPCo), to obtain title to a dam at the river's outlet from Lake Tahoe. (*United States v. Truckee River General Electric Company,* Civ. No. 14861 [N.D. Cal., Final Decree June 4, 1915]). The 1915 final decree (Lake Tahoe Decree) transferred the dam to the U. S., set a storage capacity for Lake Tahoe, granted the U. S. title to all water in the lake above the 6,229-foot elevation, and established the "Floriston rates" to regulate flows in the Truckee River at a point near the Nevada-California border. Lake Tahoe's storage capacity was set at 732,000 acre feet. The Floriston rates were established at 500 cubic feet per second (cfs) from March 1 to September 30, and at 400 cfs from October 1 through the end of February, as measured at Iceland Gage near Floriston, California. These rates were altered in 1935.

In 1925, the U. S. brought an action against over a thousand defendants to adjudicate water rights along the Carson River. (United States v. Alpine Land and Reservoir Company, et al., Equity No. D-183-BRT [D. Nev.]). The U. S. sought a decreed water right for the Carson River portion of the Newlands Project. Although the case is still pending, a temporary order was issued in 1949 and reissued in 1950 to govern until modified or replaced by a final decree.

In 1926, the U. S. Secretary of the Interior entered into a contract with the Truckee-Carson Irrigation District (TCID) to transfer operation and maintenance of the Newlands Project to the TCID from the Department of the Interior's Bureau of Reclamation. Title to the project works remained in the federal government.

In 1935, in an effort to bring the Orr Ditch litigation (lawsuit) to a close, the U. S. signed an agreement with the three major defendants in the action - TCID, SPPCo, and Washoe County Water Conservation District (WCWCD) - and with additional parties. Together the signers accounted for about 70 percent of Truckee River water use. Under the terms of the agreement, known as the Truckee River Agreement, the Floriston rates were modified to 350 cfs between November 1 and March 31 when Lake Tahoe is between 6,225.25 and 6,226.0 feet in elevation, and 300 cfs when the lake is below 6,225.25. In addition, a maximum level of 6,229.1 feet and a minimum level of 6,223.0 feet were established for Lake Tahoe, and the diverted flows of the Truckee River were divided among the parties. The diverted flow is defined to include the total of irrigation diversions and SPPCo diversions to Derby Dam minus irrigation diversions downstream of Derby Dam, any privately-owned stored water, and any natural flow in excess of the Floriston rates; this is allocated 69 percent to WCWCD and 31 percent to TCID and SPPCo, with any unused portion of the 69 percent available for use by the two latter parties.

The Truckee River Agreement cleared the way for issuance of a final decree in the Orr Ditch case, entered on September 8, 1944. The Truckee River Agreement, although it is only binding among the signatory parties, was incorporated in the final decree, as was the 1915 Lake Tahoe Decree. The Orr Ditch decree provided the government a water right with a July 2, 1902 priority to divert 1,500 cfs of Truckee River water into the Truckee Canal for irrigation and a right with a priority of December 8, 1859 to divert 30,087 acre-feet to the Pyramid Lake Reservation for irrigation. In addition, the decree specified that the Newlands Project lands were to receive a water duty of 4.5 acre-feet per acre of benchlands, and 3.5 acre-feet per acre of bottomlands. Water rights were also decreed for the many defendants.

As mentioned earlier, shortly after the final decree was entered in Orr Ditch, a temporary restraining order was issued in the ongoing Alpine case. That order, originally issued in 1949 and reissued in 1950, is known as the Alpine Decree and it applies to the Newlands Project water which comes from the Carson River. The order provided a water duty for Newlands Project lands of 2.92 acre-feet per acre; this water duty is different from the duty in Orr Ditch which applies to Truckee River water.

Besides litigation, there were many other developments and activities affecting the Truckee River throughout the first half of the 20th century. In 1903, Nevada passed the Irrigation Act of 1903. This statute established the Office of the State Engineer to administer the state's water rights. The Act also clarified that Nevada water law was to be governed by a system of prior appropriation, whereby those who diverted water and applied it to a beneficial use would gain rights to that water as of the date of diversion.

During the 1920s, Winnemucca Lake completely dried up, primarily due to the first Newlands Project diversions of Truckee River water. The decreased flows into Pyramid Lake lowered its water level, increased the water's temperature and salinity, and created a delta near the river's mouth which interfered with fish spawning runs and increased erosion in the lower river. By the 1930s, the lake's fishery had been nearly destroyed. The Lahontan cutthroat trout had disappeared completely from the lake. At the same time, development increased in the Truckee River watershed, especially in the Reno-Sparks area, requiring more diversion and use of Truckee River water.

In the Carson River Basin, the Newlands Project diversions diminished the amount of Carson River water reaching the Stillwater Marshes, the river's terminus near Carson Sink, and severely damaged the marshes' wildlife habitat. In 1931, the Fallon National Wildlife Refuge was established in the Stillwater Marshes, but little affirmative action was taken to protect the habitat until 1948 when the Stillwater Wildlife Management Area and Stillwater National Wildlife Refuge were created by agreement among the Department of Interior, Nevada Fish and Game Commission, (now Nevada Department of Wildlife) and TCID. (Tripartite Agreement, Nov. 26, 1948) The Nevada agency and the U. S. Bureau of Sport Fisheries and Wildlife (now U. S. Fish and Wildlife Service) restored over 30,000 acres of wildlife habitat in the area, utilizing return flows from Newlands Project lands. The Fernley Wildlife Management Area is supported by return flows from drainage ditches on lands along the Truckee Canal and provides several thousand acres of waterfowl habitat.

Additional Reclamation Projects and Governmental Actions (1939-1968)

In 1939, the U. S. Bureau of Reclamation completed Boca Reservoir on the Little Truckee River in California. Boca was built pursuant to the Truckee River Agreement to provide supplemental water for the Truckee River during dry periods and particularly to provide irrigation water to the Truckee Meadows. The reservoir has a capacity of 40,900 acre-feet, and is operated by WCWCD according to an agreement with the federal government.

During the 1940s, the U. S. Fish and Wildlife Service and the State of Nevada took action to repair the damage to the Pyramid Lake and Truckee River fishery. Their activities led to artificial stocking and eventual re-establishment of the Summit Lake strain of the Lahontan cutthroat trout. Fish hatcheries have been constructed at Gardnerville, Nevada, and on the shore of Pyramid Lake.

The water rights of the States of California and Nevada were not settled by the Orr Ditch or Alpine proceedings. In 1955, the states began negotiations to allocate the waters of the Truckee, Carson, and Walker Rivers between them. A commission formed and started discussions which continued for 15 years. The two state legislatures ratified a compact in 1970 (Cal. Water Code §5976; Nev. Stat. §538.600.) However, the compact has not received the required approval of the U. S. Congress.

On August 1, 1956, an additional federal reclamation project was authorized for the Truckee River watershed under the Washoe Project Act. (70 Stat. 775, 43 U.S.C. 614.) The Act authorized the U. S. Bureau of Reclamation to construct reservoirs in the Truckee Basin to improve the Pyramid Lake and Truckee River fisheries, and to provide flood control, recreation, and water for irrigation, municipal and industrial uses. Three reservoirs were authorized by this Act: Prosser Reservoir, built in 1959 on Prosser Creek (capacity-30,000 acre-feet); Stampede Reservoir, built in 1968 on the Little Truckee River (capacity-227,000 acre-feet); Watasheamu Reservoir, on the east fork of the Carson River, has not been constructed. All Washoe Project facilities are operated by the U. S. Water and Power Resources Service. The Prosser Creek Reservoir Agreement, dated June 15, 1959, specifies that the reservoir shall store Tahoe Exchange Water, a quantity of water stored in Prosser Reservoir but credited to Lake Tahoe or Boca Reservoir for release if needed to meet the Floriston rates.

The operation of Stampede Reservoir primarily for streamflow maintenance purposes is being disputed in court. (Carson-Truckee Water Conservancy District v. Andrus, discussed infra.)

Later Developments and Recent Litigation (1960s and '70s)

Throughout the 1960s, development pressures increased in the Truckee River Basin and competition for water intensified. Task forces were appointed to study the area's problems, particularly those of Pyramid Lake and its declining water level and declining fishery. In 1964, the U. S. Secretary of the Interior nominally adopted recommendations made by the Department of the Interior Task Force (Action Program for Truckee and Carson River Basins, California-Nevada, Task Force Report, October, 1964). These recommendations included suggestions that TCID be supplied with a minimum of 406,000 acre-feet of water per year for diversion at Derby Dam; that efforts be made to increase the flow into the lake by eliminating waste and delivering all water not needed by TCID to the lake; and that the Pyramid Lake Paiute Tribe be allowed to use their Orr Ditch decreed water right for uses other than agriculture. In addition, the group recommended that a fish ladder be constructed to help spawning runs in the river. This suggestion was later incorporated into the Washoe Project, and a dam and fishway were constructed at Marble Bluff near the mouth of the Truckee River.

The Pyramid Lake Task Force, appointed in 1969, also recommended getting as much water as possible into Pyramid Lake without adversely impacting other uses. The task force suggested strictly enforcing existing water rights decrees, eliminating waste in Newlands Project operations, and importing water from groundwater sources or other basins. In addition, the task force urged that the Tribe's uncertain water rights claims be resolved, that the Department of Interior continue to specify operating criteria for the two rivers which would get more water to the lake, that the fishway recommended previously be constructed, and that the federal government finance any of these measures where the benefits could not be clearly assigned to anyone else. (Pyramid Lake Task Force Final Report, December 31, 1971.)

In 1970 the California-Nevada Interstate Compact was sent to the U. S. Congress for approval. Congress, however, has never taken final action on the compact, probably because it is opposed in its present form by the Department of Interior, the Pyramid Lake Paiute Tribe, and Nevada's congressional delegation. Among other things, the compact provides for the diversion of 34,000 acre-feet per year from all sources for use within the Tahoe Basin (23,000 to California, 11,000 to Nevada). California is allocated certain storage rights to Truckee River water, including 30,000 acre-feet of storage in Prosser Creek Reservoir. Nevada's share includes the water decreed by Orr Ditch for the Pyramid Lake Reservation, and all excess water not allocated to California. The compact also divides the Carson River flow 80 percent to Nevada and 20 percent to California. Finally, the document explicitly recognizes that non-consumptive instream uses of water, such as fish preservation, are valid beneficial uses of water.

The 1970s brought much activity to the Truckee River Basin and the resulting conflicts in water use have spawned new disputes and law suits. In 1972 the Pyramid Lake Paiute Tribe of Indians brought an action in the federal district court in Washington, D. C. against the Secretary of the Interior, Roger Morton. (Pyramid Lake Paiute Tribe of Indians v. Morton, 354 F. Supp. 252 [D.D.C. 1972]). The Tribe alleged that regulations promulgated by the Secretary for the operation of the Truckee and Carson Rivers (37 Fed. Reg. 19838, implementing 43 C.F.R. §418 [1967]) allowed too much water to be diverted from the Truckee by TCID and not enough to flow into Pyramid Lake, in violation of the Administrative Procedure Act, outstanding water decrees, and the Secretary's trust responsibilities to the Tribe. Judge Gerhard Gesell agreed with the Tribe on all three grounds and ordered the Secretary to maximize the flow into Pyramid Lake and to limit TCID's annual diversion to 288,129 acre-feet.

The court's order was published as new Department of Interior regulations in 1973 (38 Fed. Reg. 47, 6697-6700.) and includes detailed instruction on storage limits, reservoir operation, and diversions within the Newlands Project. TCID objected to the criteria on various grounds and refused to follow them. On September 14, 1973, the Secretary attempted to terminate the 1926 contract with TCID for the operation of the project as of October 31, 1974. In March 1974 TCID brought an action against the Secretary contesting the criteria and the Secretary's right to terminate the contract. (TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe of Indians, Civ. No. R-74-34-BRT [D. Nev.]). The Pyramid Lake Paiute Tribe intervened on the side of the government and trial in this case took place in October 1979 before Judge Bruce Thompson in Reno federal district court.

During the pendency of the Morton case, the federal government sought to file a complaint in the U. S. Supreme Court to adjudicate water rights on the Truckee (U. S. v.

Nevada and California 412 U.S. 534 [1973]). Specifically, the U. S. claimed Winters doctrine rights, or federal reserved rights, for the Pyramid Lake Indian Reservation and other federal reservations in the area. The Winters doctrine provides that the federal government implicitly reserves water rights whenever it creates a federal reservation. (207 U.S. 364 [1908]). The rights are in amounts sufficient to fulfill the purpose of the reservation and they carry a priority date of the date the reservation was created. The Tribe's Orr Ditch irrigation rights were decreed under a reserved rights theory. In U. S. v. Nevada and California, the government claimed a Winters right to enough water to support the Pyramid Lake fishery. However, the Supreme Court refused to exercise its original jurisdiction to hear the case and suggested that the government file its suit in Nevada federal court.

In December 1973 the government filed such an action in Nevada. (U. S. and Pyramid Lake Paiute Tribe of Indians v. TCID, et al., Civ. No. R-2987-JBA [D. Nev.]), with the Tribe intervening on the government's side versus 17,000 defendants. The defendants contended, among other things, that the government's claim on behalf of the Tribe was prevented by the res judicata effect of the Orr Ditch decree, and that the Tribe is limited to the agricultural water right litigated and decreed in that case. Res judicata is a legal doctrine that provides that a cause of action which has already been litigated between certain parties cannot be relitigated between those same parties; therefore, the first action is binding.

Judge J. Blaine Anderson split the trial to consider first only the defenses, and not the merits of the Winters doctrine claim. He agreed with the defendants and held that the Orr Ditch decree bars the present assertion of a Winters right for fishery purposes at Pyramid Lake. The decision has been appealed and is currently awaiting a hearing in the Ninth Circuit Court of Appeals. (Nos. 78-1115 and 78-1493, [C.A. 9th Cir.]).

While these lawsuits were being initiated, the Endangered Species Act of 1973 was passed, (87 Stat. 884, 15 U.S.C. §§1531-1543.), which provides that federal agency action shall not jeopardize the continued existence of endangered or threatened species as designated by the Secretary of the Interior. Because the cui-ui, listed as endangered, and the Lahontan cutthroat trout, listed as threatened, are found in Pyramid Lake and the Lower Truckee River, federal actions in the Truckee Basin must conform to the Endangered Species Act.

In 1974, the City of Fallon, Nevada, filed a lawsuit against the Secretary of the Interior concerning the same regulations which are at issue in TCID's suit against the Secretary. (City of Fallon, et al. v. Secretary of the Interior, Civ. No. 74-10-BRT [D. Nev.]). This action alleged that the Secretary violated the National Environmental Policy Act by not preparing an Environmental Impact Statement before promulgating the regulations limiting TCID diversions. The City claimed that implementing the regulations would adversely affect wildlife areas, such as the Stillwater Refuge, as well as other recipients of Newlands Project water. This case has been delayed pending the outcome of TCID's lawsuit.

In 1975, the Pyramid Lake Paiute Tribe filed a petition with the Federal Power Commission (now the Federal Energy Regulatory Commission) requesting the Commission to take jurisdiction over several small dams and hydroelectric plants operated by SPPCo on the Truckee River and require licenses for them. The Tribe contended that the dams' methods of operation interfere with fish spawning runs. An administrative law judge ruled in 1977 that the Truckee was not navigable and thus there was no federal jurisdiction. However, this determination was reversed on appeal to the full commission (Federal Energy Regulatory Commission Opinion No. 61, August 10, 1979). The Commission declared the stream to be navigable and required SPPCo to file license applications for the dams. SPPCo plans to appeal the decision.

In 1976, two more lawsuits were filed. Nevada sued the United States, claiming state jurisdiction over the lands under Pyramid Lake. (Nevada v. U. S., Civ. No. R-76-235 [D. Nev.]). The federal district court dismissed the case and it is currently on appeal to the Ninth Circuit Court of Appeals. The Carson-Truckee Water Conservancy District (CTWCD), the State of Nevada and SPPCo filed an action against Secretary of the Interior Andrus to force him to allocate some of the water in Stampede Reservoir to municipal purposes in Reno and Sparks. (Carson-Truckee Water Conservancy District, et al. vs. Andrus, Civ. No. R-76-152-HEC [D. Nev.]). The water has been used mainly for maintaining instream flows in the Truckee River to benefit the fishery. The Pyramid Lake Paiute Tribe intervened on the side of the Secretary to support the use of the water for fishery purposes. This case is currently pending before Judge Thompson in Reno federal district court.

The federal water master, who is in charge of administering the Orr Ditch decree and operating the Truckee River system, filed a petition in federal district court in June 1976 to obtain instruction on how to regulate Truckee River flow within applicable decrees. (Equity No. A-3 [D. Nev.]). His petition is pending in Reno.

A dam and fishway were also built at Marble Bluff near the mouth of the Truckee in 1976. This facility was constructed by the U. S. Fish and Wildlife Service to enable the fish to bypass the delta in Pyramid Lake and reach the river for spawning. The fishway, however, requires a minimum instream flow of approximately 50 cfs at about 56° F. For this reason the Tribe requested permission from the federal court to apply their Orr Ditch irrigation water right to operate the Marble Bluff facility. In April 1979 the U. S., as trustee for the Tribe, filed a petition for a change in place and purpose of use to shift their agricultural right to fishery maintenance. (Equity No. A-3 [D. Nev.]).

Other recent court activity impacting Truckee River Basin water rights is the reopening of the Alpine case in June 1979. The United States has taken the position in this proceeding that the Carson, not the Truckee River, should be the primary source of irrigation water for the Newlands Project. The government is also suggesting that a water duty be decreed similar to that in the 1950 temporary restraining order, approximately 3 acre-feet per acre. The Tribe attempted to intervene in the Alpine adjudication to support the limitation on Truckee River water use, but their intervention was denied on the grounds that their motion was untimely and that they did not have the requisite interest in Carson River water rights.

This description of legal and institutional developments affecting the Truckee River illustrates the complexity of the region's water rights situation. The Reno-Sparks JWPCP project must take into account these complexities in the allocation of water and water rights in the Truckee River Basin in its planning and operation.

Analysis of the Institutional Constraints Affecting Truckee River Water Rights in Relation to the Reno-Sparks JWPCP Master Project

In order to understand the water rights implications of the JWPCP Master Project, to facilitate a complete evaluation of the project's impacts, and to enable meaningful choices among the alternatives, it is necessary to consider the Truckee River's legal and institutional framework in further detail, which is presented below.

Table C-1. Chronological Development of Institutional Constraints on the Truckee River

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOME
PRE-RECORDED HISTORY	Winnemucca Lake and Pyramid Lake formed as larger Lahontan Sea dried up.	Both land-locked desert lakes: Pyramid Lake maintained by flows from the Truckee River; Winnemucca Lake maintained as a playa from Pyramid Lake overflows.	Winnemucca Lake dried up in the 1920's as flows down the Truckee were reduced. Pyramid Lake's level has declined about 80 feet since the early 1900's.
PRE-RECORDED HISTORY	Pyramid Lake Paiute Tribe of Indians lived in Truckee River watershed, particularly around Pyramid Lake.	The Indians obtained their livelihood primarily by fishing in the lake and river. They also raised some crops and livestock.	In 1859, Pyramid Lake Paiute Indian Reservation was established for this tribe.
1844	John C. Fremont explores the Pyramid Lake area.	Named the lake for a pyramid shaped island; reported on Indians and the tremendous fisheries which supported them.	As lake level declined, Pyramid Island became joined to the mainland. Fish populations decreased due to decreased water flow affecting spawning runs.
Dec. 8, 1859	Pyramid Lake Indian Reservation established.	Lower 20 miles of Truckee River & area around Pyramid Lake withdrawn from public domain.	Several hundred Paiutes have occupied the Reservation since 1859.
Mar. 23, 1874	President Grant confirms establishment of reservation by executive order.		
June 17, 1902	Reclamation Act passed by Congress. (32 Stat 388, 43 U.S.C. § 371 et seq)	Act authorized massive federal irrigation projects for arid lands in western states. Nevada Senator Francis Newlands was instrumental in passage; first project under Act was Newlands Project.	Other reclamation projects eventually built in Truckee watershed, including Truckee Storage Project and Washoe Project.
1905-1915	Newlands Irrigation Project built by U.S. under authority of Reclamation Act.	Construction of Derby Dam, Truckee Canal, Lahontan Dam, & Lahontan Reservoir as primary components of Newlands Project.	Operation of Newlands Project turned over to TCID in 1926; later operation ends up in litigation.

Table C-1. Con't.

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOME
Mar. 3, 1913:filed Sept. 8, 1944:final decree	U.S. v. Orr Ditch Water Company, et al., [Equity no. A-3 (D. Nev. 1944).]	U.S. filed quiet title action against other Truckee River water users to adjudicate water rights in Truckee Basin in order to ensure adequate water supplies for the Newlands Project.	See September 8, 1944: Orr Ditch final decree.
1915	U.S. v. Truckee River General Electric Company [Civ. No. 14861 (U.S. D.C., N.D. Cal., Final Decree June 4, 1915).]	Also to ensure adequate Newlands Project water, U.S. filed condemnation action against predecessor of SPPCo to obtain title to dam at Truckee River's outlet from Lake Tahoe.	(1) U.S. obtained title to dam; (2) storage capacity for Lake Tahoe set at 732,000 acre feet; (3) U.S. granted title to all water in lake above 6229 feet elevation; (4) "Floriston Rates" set at an average flow of 500 cfs/day between March 1 and Sept. 30, and 400 cfs/day from Oct. 1 through the end of Feb., measured at Iceland Gage near Floriston, California.
1920's	First effects felt of Newlands Project diversions.	(1) Diversions of Truckee River water caused Winnemucca to dry up. (2) Flows into Pyramid Lake decreased.	(1) Lake level lowered approximately 80 feet since the early 1900's. (2) Water temperature and salinity increased. (3) Delta created near river's mouth - interferes with fish spawning runs and increases erosion in lower river.
May 11, 1925	U.S. v. Alpine Land & Reservoir Company, et al., [Equity No. D-183-BRT (U.S.D.C., D. Nev.).]	U.S. filed suit against 1000 plus defendants to adjudicate water rights along Carson River to obtain definite water right for portion of Newlands Project.	(1) Temporary order issued in 1949 and revised in 1950. No final decree. (2) Temp. order provided water duty of 2.92 acre feet/acre for Newlands Project. (This inconsistent with final Orr Ditch Decree). (3) Trial in June, 1979. No final decision yet.
Dec. 18, 1926	Contract signed between U.S. and TCID.	U.S. transfered operation of Newlands Project to TCID; Title to project remained in U.S. government.	(1) U.S. (Secretary of Interior) tried to cancel contract on September 14, 1973. (2) TCID filed lawsuit challenging cancellation, Dec., 1973. Trial-Oct., 1979. No final decision yet.
1930's	Pyramid Lake fishery severely damaged by insufficient water flows.	Lahontan cutthroat trout disappeared from lake; Cui-ui population diminished.	U.S. Fish & Wildlife Service and Nevada Fish & Game Commission take later actions to partially restore fishery.

Table C-1. Con't.

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOMES
1931	Fallon National Wildlife Refuge established.	Refuge created in Stillwater Marshes, the terminus of the Carson River, in response to habitat damage caused by New-lands Project.	Little real action taken to protect habitat until 1948, when Stillwater Refuge was created.
July 1, 1935	Truckee River Agreement signed.	U.S., in attempt to settle *Orr Ditch* case, signs agreement with 3 major defendants in action--TCID, Washoe County Water Conservation District, and SPPCo.	(1) "Floriston Rates" [established in *U.S. v. Truckee River General Electric Company* (1915)] modified: 300-350 cfs Nov. 1 - March 31, depending on level of Lake Tahoe. (2) Maximum level of 6229.1 feet & minimum level of 6223 feet set for Lake Tahoe. (3) "Diverted Flows" of Truckee divided: 69%-WCWCD & 31%-TCID & SPPCo, with any unused portion of WCWCD's 69% available for use by latter two. (4) Construction of Boca Reservoir authorized. (5) TRA laid foundation for *Orr Ditch* final decree, and became part of that decree.
1939	Boca Reservoir completed.	Pursuant to TRA, the Bureau of Reclamation built reservoir on Little Truckee River in California as part of Truckee Storage Project.	(1) Reservoir provided supplemental water for Truckee during dry periods and irrigation water to Truckee Meadows area near Reno and Sparks. (2) Reservoir operated by WCWCD; has capacity of 40,900 acre feet.
1940's	Efforts to re-establish fishery begin, using artificial hatching & stocking.	U.S. Fish and Wildlife Service and Nevada Fish and Game Commission cooperate to rebuild Truckee River-Pyramid Lake Fishery.	(1) Trout species similar to Lahontan cutthroat eventually established in Pyramid Lake. (2) Hatcheries eventually built at Gardnerville, Nevada and on shore of Pyramid Lake.
Sept. 8, 1944	Orr Ditch final decree entered.	Truckee River Agreement (binding only on signatory parties) and 1915 *U.S. v. Truckee River General Electric Co.* decree made part of final decree.	(1) U.S. granted water right (with July 2, 1902 priority) to divert 1500 cfs of Truckee River water at Derby Dam through Truckee Canal for irrigation. (2) U.S. granted water right (with Dec. 8, 1859 priority) to divert 30,087 acre feet for irrigation on Pyramid Lake Reservation. (3) Newlands Project to receive water duty of 4.5 acre feet/acre for benchlands and 3.5 acre feet/acre for bottomlands. (4) Other defendants given water rights.

Table C-1. Con't.

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOME
Nov. 26, 1948	Stillwater Wildlife Management Area & Stillwater National Wildlife Refuge created.	These 2 preserves created by agreement among Department of Interior, Nevada Fish & Game Commission & TCID (Tripartite Agreement).	30,000 acres wildlife habitat eventually restored, utilizing return flows from Newlands Project lands.
1955	California and Nevada begin negotiations on water allocation.	California & Nevada formed commission to determine allocation of waters of Truckee, Carson & Walker Rivers (Water rights of states not adjudicated in either Orr Ditch or Alpine).	Compact ratified by two states in 1970 (Cal. Water Code 5976; Nev. Rev. Stat. 538.600). Congress has not ratified compact. Major provisions: (1) 34,000 acre feet per year to be diverted from all sources for use in Tahoe Basin (23,000 to California, 11,000 to Nevada). (2) California allocated certain storage rights to Truckee water, including 30,000 acre feet in Prosser Creek Reservoir. (3) Nevada to have water decreed by Orr Ditch for Pyramid Lake Reservation & all excess water not allocated to California. (4) Carson River flow divided 80% to Nevada & 20% to California. (5) Compact explicitly recognizes non-consumptive instream uses of water as beneficial uses.
Aug. 1, 1956	Washoe Project Act (70 Stat. 775, 43 U.S.C.§614) passed by Congress.	Congress authorized Bureau of Reclamation to construct reservoirs in Truckee Basin. Specified objective of improving Pyramid Lake-Truckee River fishery.	(1) 1963-Prosser Creek Reservoir built. (2) 1968-Stampede Reservoir built on Little Truckee River in California. (3) Watasheamu Reservoir on east fork Carson River authorized but not built.
June 15, 1959	"Prosser Creek Reservoir Agreement" signed.	U.S., TCID, WCWCD, and SPPCo signed agreement providing for construction and operation of Prosser Creek Reservoir. The agreement also provided for storage of "Tahoe Exchange Water" (quantity of water credited to Lake Tahoe for release to maintain Floriston Rates)	Prosser Creek Reservoir completed in 1962 as component of Washoe Project.

Table C-1. Con't.

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOME
1962	Prosser Creek Reservoir built	Reservoir built by U.S. pursuant to 1959 agreement. Capacity of 30,000 acre feet.	
Oct., 1964	First of Department of Interior's Pyramid Lake task forces produces recommendations.	Secretary Udall officially adopted "Action Program for Truckee and Carson River Basins California-Nevada," Task Force Report.	Major Recommendations: (1) TCID should have minimum 406,000 acre feet/yr. for diversion at Derby Dam. (2) Flows to Pyramid Lake should be increased by eliminating waste and delivering all water not needed by TCID to lake. (3) Indians should be allowed to use their Orr Ditch decreed water right for uses other than agriculture. (4) Fish ladder should be constructed - (This was later accomplished as part of Washoe Project with dam and fishway constructed at Marble Bluff near mouth of Truckee in 1976).
1968	Stampede Reservoir built.	Reservoir built by U.S. on Little Truckee River in California. Capacity of 227,000 acre feet. Completed 1970.	Stampede operated by U.S. Department of Interior primarily for maintenance of instream flows; this operation challenged in 1976 by Carson-Truckee Water Conservancy District's lawsuit.
Dec. 31 1971	Pyramid Lake Task Force Final Report produced.	Second task force began work in 1969. Made recommendations in 1971.	Major Recommendations: (1) Pyramid Lake to have as much water flow as possible. (2) Existing water rights decrees should be strictly enforced. (3) Waste should be eliminated in Newlands Project. (4) Water should be imported from other basins or pumped from groundwater. (5) Indians' uncertain water rights claims should be resolved.
1970	California-Nevada Interstate Compact ratified by two states.	California statute (Cal. Water Code 5976) and Nevada statute (Nev. Rev. Stat. 538.600) adopted compact. See major provisions of compact, *supra*.	Congress has never ratified the compact, probably because of opposition by the Department of Interior, the Paiute Tribe, and Nevada's congressional delegation.
Aug. 21, 1970: filed Nov. 8, 1972: decided Feb. 20 1973: order issued	*Pyramid Lake Paiute Tribe of Indians v. Morton* [354 F. Supp. 252 (D.D.C. 1972).]	Tribe filed suit alleging that Dept. of Interior regulations for operating Truckee & Carlson Rivers allowed too much water to be diverted from Truckee and did not allow enough to flow into Pyramid Lake.	(1) Judge Gerhard Gesell of Washington, D.C. district court ordered Sec. of Interior to maximize flow into Pyramid Lake and to limit TCID's diversions to 288,129 acre feet per year. (2) Court's order published in 1973 as new regs.: 38 Fed. Reg. 47, 6697-6700. (3) TCID refused to follow regs. for operation of Newlands Project. (4) On Sept. 14, 1973 Sec. attempted to terminate (as of oct 3, 1974) 1926 contract with TCID for operating Newlands. (5) In 1974, TCID sued Sec. challenging termination.

Table C-1. Con't.

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOME
Sept., 1972: filed June 11, 19[illegible] decided	U.S. v. Nevada and California [412 U.S. 534 (1973).]	U.S. filed suit in Supreme Court, asking it to exercise its original jurisdiction to adjudicate water rights on Truckee. U.S. claimed Winters doctrine rights (or "federal reserved rights") for Pyramid Lake Indian Reservation & other federal reservations in area.	Supreme Court refused to exercise original jurisdiction. Suggested that U.S. file suit in Nevada federal district court.
Dec. 21, 1973: filed Dec. 8, 1977: decided 1978: appealed	U.S. and Pyramid Lake Paiute Tribe of Indians v. TCID, et al. [Civ. No. R-2987-JBA (D. Nev.) Nos. 78-1115 & 78-1493 (C.A. 9th Cir.)]	U.S. filed suit claiming Winters doctrine rights after Supreme Court declined to exercise original jurisdiction. Over 17,000 defendants involved.	Defendants contended that U.S.'s claim of a Winters right on behalf of Tribe barred by res judicata effect of 1944 Orr Ditch decree and Tribe limited to agricultural water right awarded in that decree. District court judge held that res judicata did apply. Decision appealed to 9th Circuit. No hearing or decision yet.
1973	Endangered Species Act becomes law (87 Stat. 884, (16 U.S.C.§1531-1543).	Provided that federal agencies' actions shall not jeopardize continued existence of endangered or threatened species as designated by Sec. of Interior.	Pyramid Lake Cui-ui designated as endangered species; Lahontan cutthroat trout listed as threatened species. (50 CFR 17.11.)
March 18, 1974	TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe of Indians [Civ. No. R-74-34-BRT (D. Nev.)]	TCID filed suit contesting 1973 Interior regulations on Newlands Project operation and Secretary's right to terminate 1926 contract for TCID's operation of Newlands Project.	Trial completed in October, 1979 before Judge Bruce Thompson in Reno federal district court. No decision yet.
1974	City of Fallon, et al. v. Secretary of the Interior [Civ. No. 74-16-BKT (D. Nev.)]	City of Fallon, Nevada filed against Sec. of Interior concerning same regs. that are at issue in TCID's suit against the Secretary, alleging that the Secretary violated NEPA by not preparing an EIS before promulgating regs. limiting TCID diversion and claiming that implementing regs. would adversely affect wildlife areas.	Suit delayed pending outcome of TCID suit against Secretary of the Interior.

Table C-1. Con't.

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOME
July 1, 1975: filed Aug 10, 1979: final decision	Federal Energy Regulatory Commission petition: Pyramid Lake Paiute Tribe of Indians v. Sierra Pacific Power (Docket No. E-9530)	Tribe filed petition with Federal Energy Regulatory Commission requestion commission to take jurisdiction over several small hydroelectric dams in Truckee system and require licenses for them.	Administrative law judge ruled on Nov. 25, 1977 that Truckee not navigable and thus there is no federal jurisdiction. Full commission reversed ad. law judge on Aug. 10, 1979 and declared stream to be navigable. Licenses required for plants, but SPPCo appealing.
1976	Nevada v. U.S. [Civ. No. R-76-235 (D. Nev.]	Nevada sued U.S. claiming state jurisdiction over lands under Pyramid Lake.	Federal district court dismissed case. Nevada appealed to 9th Circuit, case awaiting hearing and decision.
1976	Carson-Truckee Water Conservancy District et.al. v. Andrus	CTWCD, along with state of Nevada and SPPCo, sued Sec. of Interior to force him to allocate some of the water in Stampede Reservoir to municipal purposes in Reno/Sparks. (Water currently used mainly to maintain instream flows in Truckee to benefit fishery).	Motions for summary judgement currently pending in Reno federal district court before Judge Claiborne.
June, 1976	Watermaster's petition, Orr Ditch [Equity No. A-3 (D. Nev.)]	Watermaster Claude Dukes, who administers Orr Ditch decree & "operates" Truckee River, filed petition in federal district court to obtain instructions on how to regulate Truckee within applicable decrees.	Petition pending in Reno federal district court.
1976	Dam and Fishway built at Marble Bluff.	U.S. Fish and Wildlife Service constructed facility to aid in fish spawning runs.	Fishway requires minimum instream flow of 50cfs at 56°; Tribe petitioned in 1976 for a change of use allowing application of their agricultural water rights to operate Marble Bluff facilities.

Table C-1. Con't.

DATE	EVENT	DESCRIPTION/EXPLANATION	LATER DEVELOPMENTS/EVENTUAL OUTCOME
April 2, 1979: filed	Tribe's change of use petition Orr Ditch [Equity No. A-3 (D. Nev.)]	Tribe petitions federal district court in Nevada to apply their Orr Ditch irrigation water right to operate Marble Bluff facility.	No action taken as of October 1979; pending before Judge Harry Claiborne in Reno federal district court.
June 5-14 1979	Alpine case tried.	U.S. takes position that Carson River and not Truckee should be primary source of water for Newlands Project.	Trial ended June 14, 1979 before Judge Bruce Thompson in Reno federal court. No decision yet.
Aug. 10, 1979	Final decision issued by Federal Energy Regulatory Commission on Tribe's navigability petition.	Commission reversed ad. law judge's ruling of non-navigability of Truckee River. (Opinion No. 61, Docket No. E-9530)	In the future, all power plants in Truckee system will be subject to federal licensing procedures.
Oct., 1979	TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe case tried.	Trial completed on U.S.'s attempt to cancel the 1926 contract with TCID and impose regulations on Newlands Project operation.	Trial ended Oct., 1979 before Judge Bruce Thompson in Reno federal court. No decision yet.

State and Federal Water Law Principles Governing Truckee River Water Rights

Acquisition of Water and Water Rights Under State Law. Two different systems of law for the allocation of surface water exist in the United States: riparian rights and rights acquired by prior appropriation. Nevada follows the appropriation system, and California follows a combination of the appropriation and riparian systems. The major components of both systems must be understood to appreciate the complexities and uncertainties surrounding Truckee River water rights.

The riparian system is followed primarily in areas where water is plentiful. Water is owned by those owning land adjacent to the watercourse (riparian land). These owners are entitled to make reasonable use of the water for any purpose to which their land is naturally adapted. Such use may cause a diminution in the quantity or quality of the water so long as others along the watercourse are not injured. The water right is generally not transferable to non-riparian land. In shortages, all riparian right holders may have to cut back equally on their water supply. The right cannot be lost through non-use, thus, an element of uncertainty exists for other water users who face a potential reduction in their supply should any riparian choose to exercise a dormant right.

The appropriation system was developed by miners and farmers in the West and later became the law in many states. It is a first come, first served system which evolved to encourage investment in farms, ranches, mines and other development by establishing certainty in water rights. Originally, appropriative rights were acquired simply by diverting water and applying it to a beneficial use. The use did not have to be on land adjacent to the watercourse. The user obtained a water right to the amount of water diverted and used, with a priority date of the date the right was initiated. In times of shortage, those users with earlier priority dates (senior appropriators) have superior rights to use water over those with later priority dates (junior appropriators). Appropriative rights may be lost through non-use or through use that is not a reasonable beneficial use.

Today, most prior appropriation states require application to a state agency for an appropriations permit in order to validate a diversion and use. The date of application then becomes the priority date. In addition, most states provide for adjudication of water rights; when a watercourse is fully appropriated, water users may initiate judicial proceedings to have the quantities and priorities of all water rights holders on the watercourse determined, or decreed.

Pertinent Provisions of Nevada and California Water Law. In Nevada, the system of water rights is administered by the State Engineer and in California by the State Water Resources Control Board. The Nevada application form for water appropriation requires information on several water use parameters including: source of water, number of cubic feet per second (cfs) applied for, the purpose, place and period of use, and the point of diversion. If there is unappropriated water in the source, if the use will not impair the value of existing vested rights, and if it will not be detrimental to the public interest, the application will be granted. (Nev. Rev. Stat. §533.70) Conditions may be placed on the appropriation which limit and define the right, however, such as limiting the total amount of water which may be taken in a certain period, perhaps during the irrigation season.

Water in Nevada may be appropriated for any beneficial use. Beneficial use is not specifically defined, but it includes almost any use. The beneficial use is the basis, measure, and limit of the water right, i.e., a user does not have a right to any more water than he can apply to a beneficial use. (Nev. Rev. Stat. §§533.035.) In addition, the use is limited to the reasonable need and waste is prohibited. The water right becomes appurtenant to the land on which it is used, subject to the right to change the place of use discussed below.

Water rights in Nevada may be bought or sold like any property rights (or condemned using eminent domain), and water users may apply for changes in points of diversion, places of use, or purposes of use. (Nev. Rev. Stat. §§533.325, 533.345.) The State Engineer will approve changes if they do not injure others' rights or the public interest; otherwise, they must be rejected. (Nev. Rev. Stat. §533.370.) In addition, the State Engineer may place conditions on a granted change; if the terms are complied with, the original priority date remains in effect. This right to transfer and change water rights is an important one, for it can allow rights to be sold to new parties for different uses in different places. Thus, to a certain extent, availability of water is a matter of price.

Finally, water rights in Nevada may be lost through abandonment or forfeiture. (Nev. Rev. Stat. §533.060.) Abandonment requires an intent to give up the water right and some act showing non-use. Forfeiture can occur by not exercising a water right for five years, though this may not apply to rights which predate the forfeiture statute.

California's procedures differ in many ways from Nevada's, but discussion here is limited to the provisions relevant to this report. The most important difference is that California recognizes riparian rights, which are not necessarily limited by actual beneficial use. California's principles of appropriative rights are similar to Nevada's in essential respects: they are subject to abandonment and forfeiture, and reasonable beneficial use is their measure. Both California and Nevada allow appropriation of water in one state for use in the other state, and both allow for adjudication of water rights.

Implications for the Truckee River and the JWPCP. The waters of the Truckee River are essentially completely appropriated. Acquisition of water rights necessary to resolve water rights problems of the land application alternatives would have to occur through transfers or other means, according to the statutory procedures discussed above. The willingness of water rights holders to sell their rights, and the price this would require, however, are possibly limiting factors. In addition, SPPCo has a program of water rights acquisition which, although it might help solve the Truckee Meadows' long-term water supply problems, might compete with City efforts to obtain water for flow augmentation if a land application alternative were chosen [1]. Also, the requirement that other rights holders not be injured by changes in use may limit the usefulness of this technique for implementing the JWPCP alternatives.

State law procedures on transfers and changes in use may not be the only ones applicable in the Truckee River area. The Pyramid Lake Paiute Tribe's Orr Ditch Petition (sub Appendix C-1) indicates that perhaps federal common law principles will govern changes in federal rights, such as the Tribe's rights.

Other means besides transfers of water rights for reallocating water in the Truckee Basin could include more efficient management of the existing water resource by eliminating waste and identifying river storage/flow operations that serve the broadest possible range of beneficial uses. It is possible that reasonable beneficial use can be read as a limitation on existing water rights.

DRI and Walters Engineering (1979) inventoried the water rights in the Nevada portion of the Truckee River Basin and evaluated possible management schemes for more efficient use of Truckee River water to help answer some of the complex water rights problems associated with the land application alternatives. They made specific recommendations on the source and amount of potential "saved" water or water rights which could be obtained through various means. Of course, these recommendations would require further investigation before decisions regarding the viability of the land application alternatives could be made. Appropriate sections of this report are contained in sub Appendix C-2.

If the California-Nevada Interstate Compact were adopted, it would determine to a certain extent the application of California's and Nevada's water law systems to various parts of the Truckee Basin. For example, the Compact allocates 23,000 acre-feet per year from all sources for California's use in the Lake Tahoe Basin; thus, California law would probably apply to determine the water rights to any Truckee River water included in that amount.

Acquisition of Water and Water Rights Under Federal Law. Although state law governs most aspects of the allocation of water, federal powers or federal rights may take precedence in many instances over water use rights created under state law. For example, Congress has powers to regulate interstate commerce and navigation, and therefore to affect private uses of water in navigable streams. Congress also has power to acquire water and water rights for carrying out federal goals. These powers enable Congress to allocate or reallocate the waters of the Truckee River in significant ways, any of which could have substantial bearing on the Master Project alternatives. In addition, there are existing federal rights quantified and unquantified, some of which are the subject of litigation, which can affect the Master Project. These include Indian reserved water rights, non-Indian reserved water rights, and other federal rights.

General Federal Power. It is important to emphasize at the outset that the federal government has broad powers to legislate and regulate for the general welfare. This includes powers to affect and determine allocation of water in the Truckee River. The federal government's presence is felt in the Truckee River Basin in several forms: federal reclamation projects, regulatory programs under the Endangered Species Act and Clean Water Act; navigable waters jurisdiction by the Federal Energy Regulatory Commission; and proprietary interests on federally-owned lands and reservations. If the federal government wants or needs water and water rights from the Truckee River for any of these purposes, it can obtain them.

The government has the power to use purchase, condemnation, or other means to obtain water for its own uses, or to effectuate legislative or regulatory solutions for problems of allocation. The regulations promulgated by the Department of the Interior in response to the Morton case (see sub Appendix C-1) can be understood in this context. The government claims authority for the regulations because of its trust responsibility to the Pyramid Lake Paiutes, its ownership of the Newlands Projects works and the associated water rights, its reclamation law powers, and its responsibilities under the ESA. Of course, political and economic feasibility as well as specific requirements or prohibitions (i.e., reclamation law prescriptions, NEPA requirements, constitutional limits, etc.), function as practical limits on federal power, but the underlying authority must be understood in its broadest terms.

Federal Regulatory Power: The Commerce Clause. The Commerce Clause (Article 1, Section 8 of the Constitution) empowers Congress to regulate interstate and foreign commerce. This power has two aspects: federal regulation of interstate navigation and federal regulation of interstate commerce.

The power to regulate navigable waters[2] derives from a flexible construction of the Commerce Clause of the Constitution which gives Congress the power "to regulate commerce . . . among the several states . . ." Two early U. S. Supreme Court cases said that "commerce" includes "navigation" (Gibbons v. Ogden, 22 U. S. 1 [1824]) and that the power to regulate commerce includes the control of navigable waters for the purpose of navigation (Gilman v. City of Philadelphia, 70 U. S. 713 [1865]).

Subsequent Supreme Court interpretations of the power to regulate navigable waters have indicated that such power may include the power to protect the navigable capacity of watercourses by:

(1) preventing diversions of water (Sanitary Dist. of Chicago v. United States, 266 U.S. 405 [1925]);

(2) protecting non-navigable tributaries that affect navigability (United States v. Rio Grande Dam & Irr. Co., 174 U.S. 690 [1899]);

(3) preventing obstructions by bridges or dams (Union Bridge Co. v. United States, 204 U.S. 364 [1907]); Economy Light Power Co. v. United States, 256 U.S. 113 [1921]);

(4) constructing flood control structures on the navigable waters or on their non-navigable tributaries or even on the watersheds of the rivers and tributaries (Oklahoma ex rel Phillips v. Guy F. Atkinson Co., 313 U.S. 508 [1941]).

Furthermore, the power to prevent obstruction may lead to the power to license obstructions (*United States v. Appalachian Elec. Power Co*., 311 U.S. 377 [1940]). And the power to obstruct may lead to the power to generate electricity. (*Ashwander v. TVA*, 297 U.S. 288 [1936]). Significantly, the power to regulate includes the power to destroy navigable capacity of the waters and to prevent navigation (*Oklahoma, supra*; *South Carolina v. Georgia*, 93 U.S. 4 [1876]).

Judicial or statutory criteria by which to identify navigable waters vary, depending on the particular constitutional or statutory provisions or matters at issue. The basic test appears to be "whether a waterway has been used or is susceptible of being used . . . as a highway of commerce over which trade and travel may be conducted in the customary modes on inland waters." (Laurent, F. W., "Judicial Criteria of Navigability in Federal Cases," 1953 *Wis. L. Rev.* 9). Thus, a waterway continues to be navigable for commerce power purposes even if commercial uses have ceased because of artificial obstructions or changed economic conditions.

Congress has not, however, "occupied the field" and enacted legislation so sweeping and comprehensive as to exclude all state legislation and control over navigable waters. In other words, federal control does not completely preempt state regulation. The states exercise considerable control over navigable waters within their borders. There is also extensive federal-state cooperation on many water projects.

The federal government's exercise of the commerce power over navigable waters has taken many forms. For example, the U. S. Army Corps of Engineers oversees rivers and harbors and the Federal Energy Regulatory Commission licenses power plants. There are also such federal regulatory programs as EPA's water quality regulation authorized by the Clean Water Act of 1977. The Master Project is one part of this effort.

Particularly since the Truckee River has been declared navigable, EPA has wide latitude and power in this area to carry out its mandate under the Clean Water Act. All private water rights on navigable waters carry with them an inherent infirmity. Such rights are subject to the federal government's dominant navigation servitude, essentially meaning that the federal government has an easement on these waters. Furthermore, in exercising its servitude, the federal government may or may not, at its discretion, pay for the rights taken or impaired. Theoretically, the federal government, and hence the EPA, could probably take or appropriate any water necessary for carrying out its mandates in regard to the Master Project.

The second aspect of commerce clause regulation over water relates simply to commerce. Congress can regulate *any activity* which affects interstate commerce directly or indirectly. Thus, the commerce power may be exercised to regulate activities that do not themselves have an interstate character. (See *Heart of Atlanta Motel, Inc. v. United States*, 379 U.S. 241 [1964]). This regulation can include interstate trade or travel, power generation, pollution regulation, etc. If Congress ever exercised the commerce power to its fullest extent, it seems possible that every water use could be determined to affect interstate commerce, however remotely or indirectly, and could be subject to congressional controls.

Federal Regulatory Power: The Property Clause. The powers discussed above arise from Congress' authority to regulate commerce among the states. The following discussion concerns powers of control which arise as incidents of federal ownership and proprietary interests.

Federal Reserved Water Rights. The western states were carved from the public domain, land which the federal government acquired by purchase and cession. In acquiring this territory, the U. S. obtained ownership of all land, minerals and water, subject only to vested private rights at the time of cession. Federal ownership gives Congress power to withdraw land and water from the public domain for federal uses. This is the origin of federal reserved water rights. The U. S. Supreme Court recently stated the parameters of these rights:

> " . . . when the Federal Government withdraws its land from the public domain and reserves it for a federal purpose, the Government, by implication, reserves appurtenant water then unappropriated to the extent needed to accomplish the purpose of the reservation. In doing so the United States acquires a reserved water right in

> unappropriated water which rests on the date of the reservation and is superior to the rights of future appropriators. Reservation of water is empowered by the Commerce Clause, Art. I, § 8, which permits regulation of navigable streams, and the Property Clause, Art. IV, § 3 which permits federal regulation of federal lands. The doctrine applies to Indian reservations and other federal enclaves, encompassing water rights in navigable and non-navigable streams." (*Cappeart v. United States*, 426 U.S. 128, 138 [1976]).

The doctrine of federal reserved water rights was first recognized in 1908 by the Supreme Court, in a case concerning Indian water rights. In the case of *Winters v. United States* (207 U.S. 364), the Court determined that the Indians on the Ft. Belknap Reservation along the Milk River in Montana owned water rights which were superior to the most senior appropriators on the river, on the basis of an implied federal reservation theory. The Court's reasoning was that the government must have intended to reserve water for the Indians, since the purpose of the reservation was to establish an agricultural economy and since the land would have been useless for agriculture without water for irrigation. The Court concluded that whenever the federal government withdraws land from the public domain for specific purposes, it necessarily reserves from private appropriation sufficient water to fulfill those purposes.

This implied reservation theory is known as the *Winters* doctrine, and federal reserved water rights are also called *Winters* rights. The 1908 case established these rights for Indian lands; the concept of federal reserved water rights was first expressly extended to non-Indian federal reservations (i.e., wildlife refuges, national recreation areas, and national forests) by the Supreme Court in 1963. (*Arizona v. California*, 373 U.S. 546). Subsequently, numerous cases have applied the reserved water rights doctrine to all types of withdrawals and reservations from the public domain. Most of these "reserved" lands are administered by the National Park Service, Fish and Wildlife Service, Bureau of Reclamation and the Bureau of Land Management within the Department of the Interior, and the U. S. Forest Service within the Department of Agriculture.

There is an important distinction between Indian and non-Indian reserved rights. Non-Indian reserved rights, as an incident of federal property ownership, may be compromised by the government at its discretion-- by sale, limitation, or disclaimer. But Indian reserved rights--partly because their origin in some instances may be in initial Indian ownership of the lands (rather than federal ownership), and partly because they are held in trust for the Indians by the government--may not be compromised without compensation, and perhaps without the Indians' approval.

A reserved water right may be created by an act of Congress (*United States v. New Mexico*, 438 U.S. 696 [1978]), a Presidential Proclamation (*Cappaert*, *supra*), an executive order (*Arizona v. California*, 373 U.S. 546 [1963]), a treaty (*Winters*, *supra*), a Secretarial land order (*Arizona v. California*, *supra*), or other action ultimately creating a reservation (*United States v. Walker River Irrigation Dist.*, 104 F.2d 334 [9th Cir. 1939]). The *Winters* right vests immediately upon the withdrawal of land from the public domain. The water right created is not dependent on any application to beneficial use and is not lost through non-use. Since the right vests on the date land is withdrawn from the public domain, no compensation is required for private users who establish subsequent water rights which are later adversely affected by the exercise of a *Winters* right. The right exists regardless of the failure to quantify it and extends to water sufficient to meet reasonably foreseeable future needs as well as present needs (*Arizona v. California*, supra at 600 - 601). However, the water is available only to the extent it is needed to accomplish the *original* purpose for which the land was withdrawn. (*United States v. New Mexico*, *supra*).

Reserved water rights are most often created by implication rather than by express reservation. The intent to reserve water "is inferred if the . . . water is necessary to accomplish the purposes for which the land reservation is created." (*Cappaert*, *supra* at 139; see *United States v. New Mexico*, *supra* at 701 - 702). However "[w]here water is only valuable for a secondary use of the reservation . . . there arises the contrary inference that Congress intended . . . that the United States would acquire water in the same manner as any other public or private appropriator". *Id.* at 699 - 700. Thus, there is an important distinction between water to fulfill the purposes of a land reservation and water for secondary or subsidiary management purposes. Only the former water right is obtained by the act of reserving the land. In other words, the measure of the federal reserved water right is that quantity of water needed to accomplish the original purposes of the reservation and no more. (*Cappaert*, *supra*).

State law requirements such as notice of application to beneficial use are not required to perfect reserved water rights. (Cappaert, supra at 143, 145). The "volume and scope of particular reserved rights are federal questions" calling for the application of federal law (e.g., the fact that state water law systems may not provide for minimum instream flows is irrelevant if such flows are needed to carry out the purposes of the reservation), though state courts are competent to initially determine federal reserved water rights in McCarran Amendment (43 U.S.C.§ 666) proceedings. (United States v. District Court for Eagle County, 401 U.S. 520, 526 [1971]).

In sum, the federal reserved water right is created by implication as well as by express language in the reservation of public land for particular purposes. It arises from federal law, and is not dependent on state law for its existence or perfection. It does not require that water be put to actual use, and therefore is different from the concept of appropriation of water upon which Western states principally rely. It establishes a right to water to carry out the purpose(s) of the federal reservation as of the date the reservation is created, whether the water is actually put to use and whether future appropriators under state law have actual knowledge of its existence.

Because of these features (not on record, not fixed in size, not dependent on beneficial use) the federal reserved right has the potential for creating substantial uncertainty over the right to use water in areas with federal reservations. The reserved right remains viable even though no water is put to actual use. When water subject to a reserved right is put to actual use, it can impair the holders of water rights perfected under state law after the date of the federal reservation, without the federal government being obligated to compensate those holders.

To help eliminate the uncertainty surrounding these rights, President Carter has ordered all federal agencies which manage lands to establish and quantify the federal reserved rights within their jurisdiction. This action is to be accomplished primarily through administrative means, utilizing a reasonable standard when asserting a right "which reflects true federal needs, rather than theoretical and hypothetical needs based on the full legal extension of all possible rights". (Presidential Memorandum, July 12, 1978).

Implications of Federal Reserved Water Rights for the Truckee River Basin. There are some existing Winters rights to Truckee River water, and several other potential claims.

The irrigation rights decreed for the Pyramid Lake Indian Reservation by the Orr Ditch Decree are Winters rights. These rights, if recognized, would carry an 1859 priority date (as do the decreed irrigation rights), and would therefore be superior to the rights of virtually all other water users in the Truckee Basin. A Winters fishery right could amount to as much as 385,000 acre-feet of inflow to Pyramid Lake a year.

Federal Water Master, Claude Dukes, takes the position, however, that the Reservation's water rights are to natural flow only, and not to developed water, which creates much of the Truckee's present flow, particularly in dry months. If this position were followed, even the Reservation's present decreed rights would not be available during the driest periods.

The basis for the reserved rights claim for fishery maintenance is a contention that part of the purpose of the Pyramid Lake Indian Reservation at the time the reservation was made was to allow the Indians to obtain most of their sustenance from fishing. This argument is supported by reference to the documents creating the reservation, which point out the need for setting aside lands to preserve the Indians' access to Pyramid Lake and the Lower Truckee River for fishing. (See Tribe's Brief in U.S. v. TCID) In fact, the district court judge in the U.S. v. TCID suit, although he disallowed the Winters right claims on other grounds, did find that one of the purposes of the reservation was to allow the Indians to obtain part of their sustenance from fishing. (U.S. v. TCID, Civ. No. R-2987 - JBA, Finding No. 3 [D. Nev. 1977]).

There are also a number of other federal reserved lands in the Truckee Basin that may have reserved water rights, including Toiyabe National Forest, Stillwater National Wildlife Refuge, and Anaho Island National Wildlife Refuge. It is uncertain if any of these currently exercise a reserved right and what the limitations are, if any, on that right. Second, it is unknown what needs are emerging for water necessary to carry out the purpose of each reservation.

A somewhat novel question of the application of the reserved rights doctrine could arise regarding Anaho Island in Pyramid Lake. The island was reserved by executive order on September 4, 1913 as a bird sanctuary, particularly for white pelicans. The island could soon be connected to the mainland by a land bridge, as a result of the continually lowering lake level, as has already befallen the smaller Pyramid Island for which the lake is named. Creation of the land bridge would allow predators to cross to the island, endangering and possibly destroying the use of the island as a rookery. The purpose of the 1913 reservation could thus be defeated. A court might determine, under a reserved water rights rationale, that this reservation has rights to sufficient flows in the Truckee to maintain the separate existence of the island. The Anaho Island reservation, however, predates the Orr Ditch Decree and thus, it is arguable that res judicata could bar any claim for the reservation, as it might for the Pyramid Lake Reservation. However, since reserved rights for non-Indian lands were not explicitly recognized until 1963 (Arizona v. California), it would not seem fair to say that the U.S. should have asserted its claim in the early 1900s when Orr Ditch was litigated.

Recognition of a reserved water right for Anaho Island in this manner would be different from most applications of the reserved rights doctrine. The water would not be used consumptively or on the island at all. Yet, such an application would be strikingly similar to the fact situation in Cappaert. (426 U.S. 128 [1976]). The Cappaerts' pumping of groundwater on their ranch caused drawdowns in the level of an underwater ledge necessary for the breeding and continued existence of the desert pupfish. One purpose of the original reservation of Devil's Hole National Monument was to protect the desert pupfish. The Supreme Court held that there was an implied reservation of water rights and that this reservation extended to groundwater.

Another possible water rights claim could be made for the Stillwater National Wildlife Refuge and Wildlife Management Area. A water right for Stillwater might be based upon "other federal rights," discussed infra, rather than on reserved rights, depending upon the interpretation given to the mechanism for its creation. Some of this area was designated as the Fallon Wildlife Refuge in 1931 and in 1948 the Stillwater area was set aside. However, the lands have been under federal ownership and control since the region was acquired as a territory. The area requires about 92,000 acre-feet of water in a year for its maintenance. The water comes primarily from Newlands Project return flows, although before the Newlands Project was built, the area received the natural flows of the Carson River. If the flows were ceased, the refuge would remain, but significantly decrease in size and productivity. It is at least arguable that such a reduction defeats the purpose of the reservation, and thus infringes upon any federal reserved water rights the refuge may have. The impact of a refuge right on other Truckee water users would depend on how the priority date was determined. A date of 1948 might not have much of a disruptive effect; an earlier date might.

Other Federal Water Rights. [3] Besides acquiring federal reserved rights, the United States also may *appropriate* water on federally-owned land for congressionally-authorized uses. This type of right might be exercised in conjunction with a federal reservation (for example, to carry out "secondary" purposes not included in the original purpose of the reservation); or it might be exercised in connection with non-reserved lands. This right arises from actual use of unappropriated water by the U.S., in a manner similar to a private appropriator under state law. In this regard, these rights carry priority dates of the time the appropriation is actually initiated. In addition, they may not adversely affect other rights holders.

However, in certain key respects, these federal appropriative rights are different from rights obtained by private parties under state law. The rights are to use water for congressionally authorized or mandated purposes on federal lands, and thus they carry some of the weight of the Supremacy and Property Clauses of the Constitution. For example, they are not subject to state water law limitations on concepts of diversion or appropriation and beneficial use, according to the Solicitor General's Opinion, *supra*. The Supreme Court's opinion in the recent *California v. U.S.* case (46 USLW 4997, 1978) *might* modify this somewhat. That case held that federal reclamation projects had to abide by state substantive and procedural law when appropriating and using reclamation water. However, the involvement of federal *proprietary* interests here might set this instance apart from the issue in that case. And even the *California* case distinguished a situation where state law would defeat other congressional purposes or mandates.

This type of non-reserved federal right might not have great significance currently in the Truckee Basin, as it depends to some extent on the existence of unappropriated water. However, if additional water were developed in the Truckee River watershed, these potential federal rights might take on more importance. This federal right *might* have a bearing on the dispute over Stampede Reservoir's use (See sub Appendix C-1). Setting aside for a moment whether or not reclamation law and the Washoe Project Act *require* the U.S. to release Stampede water to CTWCD, the non-reserved rights argument might be applied to *authorize* or *require* the U.S. to utilize Stampede water in carrying out other purposes, i.e., the Endangered Species Act programs. Finally, the federal government can always purchase or condemn water it needs to carry out federal programs, whether or not those programs utilize federal lands. These appropriative rights are simply one manifestation of this larger federal power.

A final note on federal water rights must be added. There is a high potential for conflict over water rights among federal agencies. In the Truckee Basin, at least the following federal entities could be involved in water rights claims: Fish and Wildlife Service, Water and Power Resources Service, Bureau of Indian Affairs, Bureau of Land Management, Forest Service, EPA, Pyramid Lake Paiute Tribe, Anaho Island National Refuge, and Stillwater National Wildlife Refuge. Conflicts of interest among these bodies are probably inevitable. To the extent that one larger agency has overarching authority (i.e., the Department of Interior), conflicts could be resolved administratively. However, a congressional solution might ultimately be required.

The Proposed California-Nevada Interstate Water Compact

The respective water rights of the states of California and Nevada were not adjudicated in either the *Orr Ditch* or *Alpine* proceedings. To eliminate future controversy with respect to such rights, the two states entered into a series of negotiations beginning in 1955. These discussions were directed at allocating the flows of the Truckee, Carson and Walker Rivers between the two states. In 1970, the states adopted an Interstate Compact. (Cal. Water Code § 5976; Nev. Rev. Stat. § 538.600). It was submitted to Congress for the required federal approval. Although legislation to approve the Compact was introduced in the House in 1971 (H.R. 6078), Congress has not yet taken final action on the proposal. Without congressional approval, the Compact has no official status and is not binding upon the states (Art. XII). In its current form, the Compact is apparently opposed by the Department of Interior, the Paiute Indians and Nevada's congressional delegation.

The proposed Compact recognizes the right of the United States to store and release for beneficial use the waters of Lake Tahoe between 6,223.0 and 6,229.1 feet in elevation (Art. V-A). California would also be permitted to divert from all natural sources up to 23,000 acre-feet annually for use within the Tahoe Basin (Art. V-D). Nevada is allocated 11,000 acre-feet annually for use within the Lake Tahoe Basin (*Id.*). California is also granted the right to divert 10,000 acre-feet per year from the Truckee River, which may be stored in reservoirs when the flow at Iceland Gage exceeds 500 cfs (the maximum Floriston rates). Such diversions cannot exceed 2,500 acre-feet in any month and the amount stored in any reservoir, except Donner Lake, cannot exceed 500 acre-feet of active storage capacity (Art. VI-B-1). The amount of water which was decreed to Sierra

Valley Water Company in *United States v. Sierra Valley Water Co.*, Civil No. 5597 (N.D. Cal.)[4] is also allocated to California (Art. VI-B-2). Finally, California is granted 6,000 acre-feet annually from the conservation yield of Stampede Reservoir, subject to the execution of a contract for that amount with the United States (Art. VI-B-3). California will be permitted to develop additional yields, subject to certain limitations, when it is completely using the water allocated to it or such total use appears imminent (Art. VI-B-4). The U. S.'s right to store a maximum of 30,000 acre-feet annually in Prosser Creek Reservoir in California is also recognized and confirmed (Art. VI-C).

Nevada is allocated water in the amounts specified in the *Orr Ditch Decree* (a maximum of 30,087 acre-feet per year) for use on the Pyramid Lake Indian Reservation (Art. VI-A). The Compact recognizes the right of the U.S., acting on behalf of the Tribe, to change points of diversion, place, means, manner or purpose of use of this water through appropriate court order. (*Id.*). All other excess water not allocated to California is allocated to Nevada.

The division of the Carson River's water provided by the Compact is somewhat less complex. Nevada is allocated 80 percent of the water and California 20 percent. An additional 2,000 acre-feet per year is allocated to California for supplemental use on presently irrigated lands within Alpine County (Art. VII).

The Compact explicitly recognizes that the use of waters for preservation, protection, and enhancement of fish, wildlife, and recreation is an inseparable part of the public use of the waters of Lake Tahoe and the Truckee, Carson and Walker River Basins (Art. XIII). Each state is authorized to use water for nonconsumptive purposes, including fishery and wildlife maintenance and enhancement (Art. XIV).

If the Compact were approved in its present form, all of the Truckee River water rights in Nevada, including all the *Orr Ditch* decreed rights, the *Winters* rights established for federal reservations, and any other federal or non-federal water rights might have to come from Nevada's share of Truckee River water. This could have significant impact on the allocation of water in the Truckee Basin. Since the Compact is opposed by so many key interest groups, it might be advisable for the two states to renegotiate an up-to-date Compact, reflecting current water requirements and rights.

Other Mechanisms of Water Allocation

There are a few additional methods available which could affect water allocation in the Truckee River Basin. Congress has the power to allocate water between states by statute, in the absence of an interstate compact. States which have actual disputes over water distribution may sue in the Supreme Court for an adjudication and decree of their respective rights.

Activities internal to a state may also impact water allocation and use, such as state laws requiring certain types of water conservation. This might include such simple measures as requiring water meters to reduce water consumption. Under state law, "saved water" generally may be used by the person making the savings. The proposed DOI regulations on Newlands project operation (see sub Appendix C-1) raise an interesting application of saved water. In that instance, the U.S. is attempting to "save" water from its irrigation water right for the Newlands Project and apply it to fishery maintenance purposes in Pyramid Lake. (See, e.g., Tonkin v. Winzell, 27 Nev. 88, 73 Pac. 593 [1903]).

The Endangered Species Act

The Endangered Species Act of 1973 (ESA) (87 Stat. 884, 16 U.S.C. § 1531-1543) is a significant constraint on activities in the Truckee Basin, including the planning and operation of the project alternatives for the Reno-Sparks JWPCP Master Project. The Act is broad in its reach and mandatory in its language. For instance, it can be a complete bar to federal agency action, including authorizing, funding, or carrying out any project. Any person may sue under the Act to enjoin anyone, including the United States and any other governmental instrumentality or agency, alleged to be in violation of any provision of the Act or of any regulation promulgated under the Act. These two aspects alone establish the need to examine the potential application of the Act to the Truckee River and the JWPCP in some detail.

The following analysis first considers the general purpose of the Endangered Species Act. Next, the Act's requirements are discussed, followed by an interpretation of its potential scope. The process of exempting certain activities from the Act's requirements is then reviewed. Finally, the significance of the Act to the Truckee River and the JWPCP is analyzed.

The Purpose of the Endangered Species Act. The central purpose of the Endangered Species Act is to halt and reverse the trend toward species extinction through limitations on the actions of federal agencies. (TVA v. Hill, 437 U.S. 153, 98 S.Ct. 2279 [1978]). In enacting the ESA, Congress made a conscious decision to give endangered species priority over the primary missions of federal agencies. (Id.) The Act contains clear directives:

> Each federal agency shall, in consultation with and with the assistance of the Secretary (of the Interior), insure that any action authorized, funded, or carried out by such agency . . . does not jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary . . . to be critical, unless such agency has been granted an exemption for such action . . . . (ESA § 7 [a], 16 U.S.C. § 1536 [a]).

Thus, the object of the ESA is to prevent federal agencies from authorizing, funding, or carrying out any actions which jeopardize endangered or threatened species or their critical habitats.

The Requirements of the Endangered Species Act. The ESA directs the Secretary of Interior to take several actions to implement the policy of species preservation. After initially listing endangered and threatened species according to the Act's specifications, (ESA § 4, 16 U.S.C. § 1533), the Secretary is to review the list for possible revisions, additions, or deletions every five years. (ESA § 4 [c] [4], 16 U.S.C. § 1533 [c] [4]). In addition, if an interested person (interested person pursuant to 5 U.S.C. § 533 (e) Administrative Procedure Act) petitions the Secretary (with substantial supporting evidence) to review the status of any listed species, the Secretary must conduct such a review. (ESA § 4 [b] [4], 16 U.S.C. § 1533 [b] [4]).

Whenever a species is designated as threatened, the Secretary of Interior is supposed to issue regulations to provide for its conservation. (ESA § 4 [d], 16 U.S.C. § 1533 [d]). "Conservation" means to use all necessary methods and procedures to remove the species from its endangered or threatened status. (ESA § 3 [3], 16 U.S.C. § 1532 [3]).

The Secretary is directed to review all other programs he administers to make sure they are conducted in furtherance of this Act's purposes. (ESA § 7 [a], 16 U.S.C. §1536 [a]). Furthermore, the Secretary is to develop recovery plans and programs for conserving endangered and threatened species. (ESA § 4 [g], 16 U.S.C. § 1533 [g]; ESA § 5, 16 U.S.C. § 1534). The Secretary is also instructed to cooperate with the states in administering the Act. (ESA § 6 [a], 16 U.S.C. § 1535 [a]). In doing so, he may enter into agreements with the states to establish conservation programs. (Id. at [b] and [c]).

The Act authorizes the Secretary of Interior and the Secretary of Agriculture (regarding national forest lands) to acquire "land, water, or interests therein" to help carry out programs of species conservation. (ESA § 5, 16 U.S.C. § 1534). Finally, the Secretary may establish some areas as "critical habitat" for a threatened or endangered species, which means that these areas are essential to species preservation and special management may be required. (ESA § 3 [5], 16 U.S.C. § 1532 [5]). The designated habitat is then protected from agency destruction or adverse modification. (ESA § 7 [a], 16 U.S.C. § 1536 [a]).

The Secretary is given authority to enforce the Act by Section 11. (16 U.S.C. § 1540). He may assess civil monetary penalties after notice and an administrative hearing; if the fines are not paid, he may take the violator to court. (ESA § 11 [a] [1], 16 U.S.C. § 1533 [a] [1]). In addition, the Act provides for criminal penalties (ESA § 11 [b], 16 U.S.C. § 1540 [b]) and citizen suits (§ 11 [g], § 1540 [g]).

Beyond these directives to the Secretary of Interior, the Act requires certain actions of all federal agencies. All agencies are to carry out species conservation programs. (Id.) They are to "insure" that their actions (actions they authorize, fund, or carry out) do not jeopardize listed species or critical habitats. (Id.) The agencies are required to consult with the Secretary to achieve these ends. (Id.) Frequently, the consultation process results in modification of the proposed action that enables both the continuation of the project and the protection of the species. In addition, agencies must conduct biological assessments to identify listed species likely to be affected by an agency action. (ESA § 7 [c], 16 U.S.C. § 1536 [c]). The assessments may be done as part of an agency's NEPA compliance, but they must be done before any construction is begun or construction contract entered into. (Id.)

Once the consultation process has begun, an agency may not make any irreversible resource commitments which might limit the options for species or habitat protection. (ESA § 7 [d], 16 U.S.C. § 1536 [d]). After consultation is completed, the Secretary must issue an opinion on how the agency's action will affect the species or habitat and how the impacts could be avoided. (ESA § 7 [b], 16 U.S.C. § 1536 [b]). [5] If the opinion indicates that the agency action may jeopardize a listed species or critical habitat, the agency must either modify its action or apply for an exemption from the ESA (see discussion below).

The ESA seems to require affirmative actions by federal agencies to improve the status of listed species, so they can eventually be removed from the lists. (See ESA § 3 [3], 16 U.S.C. § 1532 [3]; Defenders of Wildlife v. Andrus, 428 F. Supp. 167 [D.D.C. 1977]; Connor v. Andrus, 453 F. Supp. 1037 [D. Tex. 1978]). Finally, in order to "insure" that their actions do not jeopardize listed species, agencies probably must consider secondary impacts of their actions. (National Wildlife Federation v. Coleman, 529 F. 2d 359 [C.A. Miss. 1976], rehearing denied 532 F. 2d 1375, certiorari denied 429 U.S. 979, 97 S. Ct. 489, 50 L. Ed. 2d 587).

Receiving an exemption pursuant to the statutory exemption process is only one way to avoid the requirements of the ESA. Before describing these procedures, the potentially broad scope of the Act is discussed below.

The Scope of the Endangered Species Act. In general, the ESA speaks only to the activities of federal agencies. [6] However, it is possible that non-federal entities may be subject to the Act's strictures as well, perhaps even after a project has been approved and built, although no cases directly addressing this question were found. The analysis which follows is based upon our interpretation of the Act and discussions with persons involved in its administration. For instance, an issue of ESA application could arise during the operation of a project that did not arise in its planning, authorization, funding and construction. Species could become significantly weaker; new data may be developed on a species; old data that were not considered earlier may surface; or even a new, endangered or threatened species could be uncovered.

In the instance of a completed project, the Act's application might be triggered by the issuance of an operating permit for a project. A state or local permit issued according to guidelines mandated by a federal agency or issued in implementation of a federal program might be subject to the Act, particularly if that permit is subject to periodic approval. The issuance of the permit could possibly be considered a federal agency action within the meaning of the Act. Perhaps the federal agency would have to revise its program, guidelines, or approvals to bring them into conformity with the Act.

Such an interpretation would be consistent with the purposes of the Act, particularly in areas such as pollution emission permits, where state agencies largely execute a federal mandate. Thus the ESA may be a significant constraint on the operation of a project even after it is completely built, and hence may indirectly impact non-federal agencies.

The applicability of the Act to partially completed projects is no longer in doubt after the Supreme Court's decision in TVA v. Hill, 437 U.S. 153, 98 S.Ct. 2279 (1978). In that case, the Court enjoined the Tellico Dam project even though substantial investments had been made and significant construction completed. (Recently, Congress gave special approval for the completion of Tellico Dam but it did not thereby alter the terms of the ESA.)

State regulatory agencies and their licensees may not be the only non-federal agency parties to be affected by the Act. Parties contracting with a federal agency may find themselves in essentially the same position as state agencies in that they may have to follow guidelines which the contracting federal agency must enforce according to the mandates of the Act. Thus if the Secretary of the Interior could not authorize, fund or carry out an action prohibited by the Act, he probably could not contract to carry out the same thing. The potential scope of the ESA is therefore very broad indeed.

Exemptions from Endangered Species Act Requirements. If an agency has consulted with the Secretary of the Interior on the impacts of a proposed action and the Secretary has issued a negative opinion, in order to proceed with the action the agency must request an exemption. (ESA § 7 [g], 16 U.S.C. § 1536 [g]). The governor of a state where an action was to take place or the applicant for a federal permit or license to perform the action (whose application was denied because of the ESA) may also request an exemption. (Id.)

The application for exemption is submitted to the Secretary; it is considered first by a review board (made up of a Presidential appointee, a Secretarial appointee, and an administrative law judge chosen by the Civil Service Commission) which makes recommendations to the Endangered

Species Committee (ESC - consisting of several federal agency heads and representatives of affected states). (ESA § 7 [e] and [g], 16 U.S.C. § 1536 [e] and [g]). The application must include at least a description of the consultation process carried out and a statement of why the action cannot be modified to conform to the Act's requirements. (ESA §7 [f], 16 U.S.C. § 1536 [f]).

The board's job is to review the consultation conducted and determine (1) whether an irresolvable conflict exists and (2) whether the exemption applicant has (a) acted in good faith and tried to develop and consider mitigation measures, (b) conducted the required biological assessment, and (c) refrained from irretrievably committing resources and foreclosing options. (ESA §7 [g] [5], 16 U.S.C. §1536 [g] [5]). An "irresolvable conflict" simply means that the action will jeopardize a listed species or its critical habitat. (ESA §3 [11], 16 U.S.C. §1532 [3] [11]). If the board makes positive determinations on all these things, it reports to the ESC. (If any answers are negative, the exemption application does not proceed beyond this point.) The report considers: alternatives to the action and the benefits (for species conservation) of the action and alternatives; whether the agency action is in the public interest or has regional or national significance; and appropriate mitigation measures.

The ESC then makes a final determination on whether to grant an exemption. To do so, it must find that there are no reasonable alternatives to the proposed action, that the action is in the public interest and its benefits outweigh that of any alternatives consistent with species conservation, and the action is of regional or national significance. (ESA §7 [h], 16 U.S.C. §1536 [h]). Finally, the ESC must establish mitigation measures to minimize the agency's action's adverse impacts. (Id.) The ESC's decisions on exemptions are subject to judicial review in federal courts of appeal. (ESA §7 [n], 16 U.S.C. §1533 [n]).

Two projects have been considered for exemption by the ESC to date: Tellico Dam and Grayrocks Dam.[7] Exemption was denied in the Tellico case and granted for the Grayrocks project. However, both were treated by the committee on a statutorily expedited basis, so it is difficult to draw conclusions on how the full exemption process will actually be applied.

The Significance of the Endangered Species Act to the Truckee River and the JWPCP. The presence of the endangered cui-ui (Chasmistes cujus) and Lahontan cutthroat trout (Salmo clarki) in the Truckee River system is the basis for application of the ESA to projects affecting the river. The listing of the cui-ui as endangered means that the Secretary has determined that it is "in danger of extinction throughout all or a significant portion of its range". The listing of the Lahontan cutthroat trout as threatened means that it is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range". (ESA §§3 [6] and [20], 16 U.S.C. §§1532 [6] and [20]).[8]

The presence of these two species in the river means that all federal agencies authorizing, funding, or carrying out projects in the area must insure that their actions do not jeopardize the continued existence of either species. At this time there is no critical habitat designation for any part of the Truckee River system;[9] if such a designation were made in the future for either species, federal agencies would also have to insure that their actions would not destroy or adversely modify that habitat.

The federal agencies which currently conduct activities in the Truckee River area include at least: the Department of Interior (including the Water and Power Resources Service, Bureau of Indian Affairs, Fish and Wildlife Service, Bureau of Land Management, and National Park Service); the Department of Agriculture (Forest Service); and the EPA. These agencies must conform their actions along the Truckee River to the requirements of the ESA discussed above. This includes consulting with the Secretary of the Interior (the Fish and Wildlife Service), modifying any proposed project in response to a negative opinion on the project's impacts (or applying for an exemption), and taking all steps necessary to insure that agency actions in the Truckee watershed do not jeopardize the survival of the cui-ui lakesucker and the Lahontan cutthroat trout. It also includes not irreversibly committing any resources or foreclosing any options for avoiding jeopardy to those species during any consultations. Furthermore, the impact of the Act may extend to non-federal entities in the Truckee Basin who are acting on behalf of federal agencies, according to the discussion above.

The Secretary of Interior and the Secretary of Agriculture could utilize their acquisition powers in the Truckee Basin to obtain land, waters or other interests in furtherance of conservation programs to improve the status of the two fish. Conceivably, the Secretary of Interior could purchase (from voluntary sellers or by eminent domain) enough water rights to insure a satisfactory instream flow to support the fish species.

The ESA clearly has significant implications for the planning and operation of the JWPCP Master Project. EPA, as a federal agency, must insure that its authorization and funding of the treatment and disposal alternatives do not jeopardize the continued existence of either fish species. This may include choosing project alternatives which would have the least negative impact on the species. Specific conservation measures would have to be worked out during the consultation required by the Act.

Even if the EPA could avoid the ramifications of the ESA during the planning and construction stages of the Master Project, it is possible that the operation of the plant, at least initially, will be subject to the Act's requirements according to the analysis discussed previously. The plant will require a periodic National Pollution Discharge Elimination System (NPDES) permit. Although this permit will be issued by the State of Nevada, the water quality standards upon which it will be issued must be approved by the EPA.[10] This may make the standards and the permit vulnerable to the requirements of the ESA. EPA may have an obligation under the ESA to set (or approve) standards which would avoid acute and chronic toxicity and encourage the propagation of the two fish species.

The Endangered Species Act should not be underestimated in its potential impact on the JWPCP expansion and other federal projects authorized, funded, or carried out (directly or indirectly) in the Truckee River watershed. The Act is strong legislation; violation of any of its provisions exposes the violator to suit by any individual or the Secretary of the Interior. The outcome of such a suit could be the enjoining of project construction and perhaps operation, regardless of project expenditures in time or money.

Legal Constraints on Water Storage, Flows and Diversions in the Truckee River System

The following section contains brief summaries of major legal constraints affecting reservoir storage and operation, stream flow maintenance, and diversion limitations in the Truckee River Basin. The five major reservoirs, flow measurement, and diversion points are discussed with the major legal constraints impacting the storage, flows, and diversions: the 1944 Orr Ditch Decree and the 1935 Truckee River Agreement (which is part of that decree); the regulations issued the the Department of the Interior regarding the Newlands Project operation; and current litigation or other legal action necessary concerning Truckee River water rights and water use.

Orr Ditch Decree and Truckee River Agreement.

Water Bodies.

1. Lahontan Reservoir. Claim No. 3 of the Decree simply notes that Lahontan Reservoir has a capacity of 290,000 AF. (Page 10). The Truckee River Agreement (TRA) gives the Truckee-Carson Irrigation District (TCID) and the U.S. the right to enlarge Lahontan Reservoir. (Art. XIII).

2. Lake Tahoe. Claim No. 4 of the Decree entitles the U.S. to a flow of 3,000 cfs into Lake Tahoe. The U.S. may regulate the lake's storage and discharge at its discretion, governed by the provisions of the 1915 Lake Tahoe Decree; specifically, it may discharge enough water to deliver 1,500 cfs after transportation losses to Derby Dam. However, the U.S. may not discharge more than 3,000 cfs at any time. (Page 11) (The TRA modified this somewhat).

The TRA provides detailed requirements for Lake Tahoe's operation: all water in the lake which can be released shall be released to maintain the Floriston rates or the reduced Floriston rates (see discussion below: these rates also depend on the lake level); however, the discharges are not to exceed those rates unless the Washoe County Water Conservation District (WCWCD), the Sierra Pacific Power Company (SPPCo), and TCID agree otherwise. (Art. III, PB [1] and [2]). The discharges from the lake to maintain Floriston rates may be reduced when equivalent amounts of privately owned stored water have been discharged into the river to meet the rates instead. (III-B-4). When lake level is fairly high during the summer, discharges are to be reduced, and water to maintain Floriston rates is to be supplied first from other sources; when lake level is lower, lake water is to be discharged first. (III-C-[1] and [2]). When lake level is greater than 6,225.5, supplemental storage water from Boca Reservoir is released; when lake level is less than or equal to 6,225.5, lake water is released first (Id.) In the winter (Oct. 31-March 1), supplemental storage water is used to maintain the Floriston rates rather than Lake Tahoe water. (III-C-[2], [3] and [4]).

During December, January, and February, Lake Tahoe water is to be released at the request of SPPCo for ice removal purposes; the quantity released does not need to be more than sufficient to maintain a flow in excess of the Floriston rates. (III-E).

The TRA sets the maximum elevation of Lake Tahoe at 6,229.1 feet and prescribes a method for estimating the lake level and timing precautionary drawdowns. If the estimated lake level for a season is greater than 6,230.0, water is to be released to a level of 6,228.0. If the actual lake level is greater than 6,228.0, water is to be released until estimates show that the lake level will not exceed 6,229.1. These releases are not to exceed those allowed by the 1915 Lake Tahoe Decree unless SPPCo and U.S. agree otherwise and petition the court for permission to deviate. (III-E).

3. *Prosser Reservoir.* The construction of Prosser Reservoir postdates the Orr Ditch Decree and the TRA.

4. *Boca Reservoir.* The TRA provided for construction of Boca Reservoir on the Little Truckee River by agreement between WCWCD and the U.S. Boca's capacity was set at "not less than 40,000 AF", with a discharge capacity of not less than 500 cfs. (Art. II-B). The WCWCD was given the right to impound 25,000 acre-feet of "Truckee Canal Water" between Oct. 1 and Sept. 30, as long as the impoundment does not reduce the natural flow at Iceland Gage below the Floriston rates. (Art. IV-A). ("Truckee Canal Water" is 1,500 cfs of the Truckee River's flow; "natural flow", in this case, is all river water besides impounded and released water, water from other watersheds, Hunter Creek power diversions, and Lake Tahoe releases [Art. I]). In addition, WCWCD may divert more Truckee Canal Water up to the reservoir's capacity, but only if this will not reduce the water available for diversion at Derby Dam below the capacity of the Truckee Canal, which is set at a maximum of 1,200 cfs. (Art. IV-B).

WCWCD is supposed to maximize storage in the reservoir; at the same time, it is supposed to maximize water available to TCID for diversion. (Art. IV). Boca Reservoir water, like Lake Tahoe water, is not supposed to be released at flows in excess of the Floriston rates unless agreed to by WCWCD, SPPCo, and TCID. (Art III-A-[2]).

Although Boca Reservoir water can be released under certain conditions to modify the Floriston rates (see discussion below), the water impounded in the reservoir from Oct. 1 to April 1 should remain there, except at WCWCD's option. (III-C-[5]).

Between April 1 and Oct. 31, WCWCD is to release up to 4,000 acre-feet of "supplemental storage water" (the first 25,000 acre-feet of reservoir water) to help maintain SPPCo pondage on the river and the Floriston rates. (Art III-C). During December, January, and February, WCWCD is to release water for ice removal at SPPCo's request, with the same conditions of release as for Lake Tahoe ice removal water, discussed above. (Art. III-E-[2]).

"Additional supplementary storage water" (beyond the first 25,000 acre-feet) may be released between April 1 and Sept. 10 for all the same purposes as supplementary storage water, if the supplementary water has all been released. Between Sept. 11 and Jan. 31, all additional supplementary storage water that was impounded before Oct. 1 is to be released, if the supplementary water has already been released; Lake Tahoe drafts are reduced accordingly. From Feb. 1 to March 31, releases of additional water may be made at WCWCD's option; again lake drafts are reduced accordingly. (Art. III-G).

5. *Stampede Reservoir.* The construction of Stampede Reservoir postdates the Orr Ditch Decree and the TRA.

Flow Points.

6. *Floriston Rates (Iceland Gage).* Floriston rates are defined as an average flow of 500 cfs/day between March 1 and Sept. 30, and 400 cfs/day from Oct. 1 through the end of February, measured at Iceland Gage near Floriston, California. Reduced Floriston rates are 350 cfs between November 1 and March 31 when Lake Tahoe is below 6,226.0 elevation but not below 6,225.25, and 300 cfs when Lake Tahoe is below 6,225.25. These rates must be maintained at the specified times, unless certain conditions occur. (Art. III).

SPPCo may request rates in between the two when reduced rates are in effect. The U.S. and TCID or WCWCD must comply as far as practicable, using lake water or supplemental and additional storage water or privately owned stored water. However, total releases on any day are not to exceed (by more than 6,000 acre-feet) or be less than (by more than 6,000 acre-feet) the amount that would have been released between that date and the date of the TRA if the flow rates had been maintained pursuant to the TRA. (Art. III-B-[2]).

When the reduced rates are in effect, up to 1,500 cfs of water may be released at SPPCo's request if SPPCo is suffering breakdowns and has released a maximum amount of its own stored water. (Art. III-B-[4]).

Diversions. Generally, the TRA divided the "diverted flow" (total amount of all water diverted from the Truckee River between Iceland Gage and Derby Dam, including Truckee Canal water and that bypassed at Derby Dam [which is in excess of downstream irrigation needs] made up of natural flow [except that in excess of Floriston rates], Lake Tahoe releases, Boca Reservoir releases, and privately owned stored water used to maintain Floriston rates] [Art. I-A]) between TCID and SPPCo (31 percent) and WCWCD and others (69 percent). TCID and SPPCo can use any unused portion of the 69 percent. WCWCD is given the right to use any of the 69 percent beyond natural flow; however, the land this water is used on must be within WCWCD's boundary, contiguous to areas with Truckee River water rights, and it cannot exceed 5 percent of the total area between Iceland Gage and Derby Dam entitled to Truckee River water use. In addition, WCWCD's rights are subject to SPPCo's right to divert its 40 cfs of decreed rights. (Art. VII). (See excerpt below for TRA section defining "diverted flow").

> (A) DIVERTED FLOW means the total amount at any specified time of all water diverted from the Truckee River (determined by simultaneous measurements in cubic feet per second), at points between ICELAND GAGE and Derby Dam (including water diverted by the Truckee Canal and the water by-passed at Derby Dam in excess of irrigation requirements below Derby Dam as provided in the TRUCKEE RIVER FINAL DECREE), consisting of (1) NATURAL FLOW, (2) water released from Lake Tahoe, (3) water released from SUPPLEMENTAL RESERVOIR, and (4) PRIVATELY OWNED STORED WATER referred to in subparagraph (4) of Paragraph (A) of Article III of this agreement: provided that DIVERTED FLOW shall not include (1) released PRIVATELY OWNED STORED WATER (other than PRIVATELY OWNED STORED WATER referred to in subparagraph (4) of Paragraph (A) of Article III hereof). (2) NATURAL FLOW in excess of FLORISTON RATES at ICELAND GAGE, (3) water diverted for the generation of electrical energy and other power, and/or for the removal of ice as provided in Paragraph (E) of Article III and Paragraph (B) of Article V hereof, which is returned to the Truckee River.
>
> The amount of DIVERTED FLOW at any specified time shall be determined by adding: (1) the amounts of all waters diverted at such time from the Truckee River by

> conduits having their places of diversion in said River between ICELAND GAGE and Derby Dam (including Truckee Canal) and (2) the amount of water (if any) by-passed at Derby Dam in excess of irrigation requirements below said Derby Dam as provided in the TRUCKEE RIVER FINAL DECREE, and subtracting from the result of such addition the aggregate of: (1) the amount of water diverted at such time for the generation of electrical energy or other power, and/or for the removal of ice as mentioned in Paragraph (E) of Article III and Paragraph (B) of Article V of this agreement, and which is returned to said River, (2) the NATURAL FLOW at ICELAND GAGE in excess of FLORISTON RATES, (3) the amount of PRIVATELY OWNED STORED WATER (other than PRIVATELY OWNED STORED WATER referred to in subparagraph (4) of Paragraph (A) of Article III hereof) diverted at such time by said conduits. The result shall be the amount of DIVERTED FLOW at such time. For the purpose of the foregoing computations all measurements of water shall be made in cubic feet per second.

7. *Truckee Canal (TCID).* The Decree awarded the U.S. a right to divert 1,500 cfs of water from the Truckee River at Derby Dam into the Truckee Canal to provide irrigation water to the Newlands Project. The water right has a priority date of July 2, 1902. The water may not exceed 3.5 acre-feet per acre as applied on bottom lands, nor 4.5 acre-feet per acre as applied on bench lands. (Pages 10-11).

Other conditions include a limitation to 2/3 of the water duty per acre when the crop being irrigated is grain and 4/5 when the crop is potatoes, corn or beets, and an allowance of an additional 10 percent when it is new alfalfa. During any month, an irrigator cannot use more than 25 percent of the entire season's allotment. Liberal allowance for transportation loss is made; the duty of water is the controlling factor. However, waste is prohibited and reasonable, beneficial, and economical use is mandated. (Pages 86-88).

The TRA allows TCID and the U.S. to enlarge Truckee Canal to a capacity of 1,200 cfs. (Art. XIII).

8. *Pyramid Lake Indian Reservation.* The Decree provides the U.S. may divert up to 14,742 acre-feet of water per year through Indian Ditch for irrigating 3,130 acres of bottom land on Pyramid Lake Indian Reservation. The diversion is not to exceed 58.7 cfs, nor is it to exceed one miner's inch (1/40 of one cfs) per acre for

the aggregate number of acres being irrigated each year. The amount applied is not to exceed 85/100's of a miner's inch per acre for the total acreage irrigated. The amount diverted is limited to 4.71 acre-feet for the aggregate acreage irrigated (14,742 acre-feet maximum), and the amount applied is limited to 4 acre-feet (12,520 acre-feet maximum). (Page 10).

The Decree also awards 1/40 of one cfs (or one miner's inch) per acre for irrigating 2,745 acres of reservation bench lands. The water may be diverted through any ditch including the Truckee Canal. A maximum of 5.59 acre-feet per acre may be diverted during any year (15,345 acre-feet) and a maximum of 4.1 acre-feet per acre may be applied (11,254 acre-feet). (Page 10).

9. SPPCo (Reno-Sparks M&I Water). The Decree and the TRA give SPPCo a right to divert a maximum of 40 cfs through Highland Ditch to supply Reno and Sparks with water for municipal uses. In addition, SPPCo may divert about 13.6 cfs from Hunter Creek for the same purposes. (see sub-Appendix C-1).

Department of Interior Regulations.

Water Bodies.

1. Lahontan Reservoir. Under the Department's regulations (at issue in TCID v. U.S., supra the storage in Lahontan Reservoir would be regulated by limiting TCID's diversions into the reservoir from both the Truckee and Carson Rivers. The total annual diversion from both rivers for the Newlands Project would be limited to 288,129 acre-feet. The amount of water allowed to be diverted to and stored in Lahontan Reservoir at any given time depends upon runoff and rainfall in the Truckee River watershed (measured at Tahoe City) and existing storage in the Reservoir. For various precipitation and runoff levels each month, there are lower limits and upper limits specified for the reservoir; allowable diversions into the reservoir are based upon those two limits according to the chart below.

Operating month	If accumulated precipitation from Oct. 1 to date at Tahoe City, Calif. is:	Continue Truckee Canal Diversion to Lahontan Reservoir if storage is less than upper limit			
		Lower limit[1]		Upper limit	
November -March	Inches	Elev.	Ac.Ft.	Elev.	Ac.Ft.
November 1	Less than 5.00	4123.3	60,000	4124.3	63,000
	Equal or Greater than 5.00	4103.6	20,000	4105.8	23,000
December 1	Less than 5.00	4129.3	80,000	4130.1	83,000
	Between 5.00 & 10.70	4123.3	60,000	4124.3	63,000
	Greater than 10.70	4115.4	40,000	4116.8	43,000
January 1	Less than 10.70	4138.5	120,000	4139.1	123,000
	Between 10.70 & 16.80	4131.8	90,000	4132.6	93,000
	Greater than 16.80	4123.3	60,000	4124.3	63,000
February 1	Less than 16.80	4145.8	160,000	4146.3	163,000
	Between 16.80 & 22.10	4138.5	120,000	4139.1	123,000
	Greater than 22.10	4129.3	80,000	4130.1	83,000
March 1	Less than 22.10	4151.8	200,000	4152.2	203,000
	Between 22.10 & 26.10	4144.1	150,000	4144.6	153,000
	Greater than 26.10	4134.2	100,000	4134.9	103,000

	If forecasted runoff plus existing storage on April 1 is:				
April-October	Ac.Ft.	Elev.	Ac.Ft.	Elev.	Ac.Ft.
April 1	Greater than 350,000	No diversion to Lahontan thru October			
	Between 250,000 & 350,000	4154.3	220,000	4154.7	223,000
	Less than 250,000	4159.8	270,000	4160.1	273,000
May 1	Between 250,000 & 350,000	4151.8	200,000	4152.2	203,000
	Less than 250,000	4162.6	300,000	4162.8	303,000
June 1	Between 250,000 & 350,000	4144.1	150,000	4144.6	153,000
	Less than 250,000	4157.7	250,000	4158.1	253,000
July 1	Between 250,000 & 350,000	4134.2	100,000	4134.9	103,000
	Less than 250,000	4145.8	160,000	4146.3	163,000
August 1	Between 250,000 & 350,000	4129.3	80,000	4130.1	83,000
	Less than 250,000	4131.8	90,000	4132.6	93,000
Sept 1	Less than 350,000	4119.7	50,000	4120.8	53,000
October 1	Less than 350,000	4115.4	40,000	4116.8	43,000

[1] Truckee Canal Diversion to Lahontan Reservoir should be started only when storage recedes below lower limit.

Furthermore, the operation of Lahontan Reservoir is tied into the operation of Stampede Reservoir. The basic objective is to minimize storage in Lahontan Reservoir and maximize storage in Stampede, while still delivering necessary water to TCID. Under certain conditions, TCID receives "storage credit" in Stampede in lieu of actual storage in Lahontan Reservoir. At no time may the water stored in Lahontan Reservoir, together with the amount of water stored in Stampede for which TCID has storage credit, exceed 317,300 acre-feet. Whenever the level of Lahontan drops below 4,129 feet in elevation (80,000 acre-feet) during the irrigation season, water is to be released from Stampede and diverted through the Truckee Canal for agricultural use by TCID. The amount diverted would be limited to the lesser of either TCID's credited storage or the amount needed to meet the district's remaining seasonal agricultural requirements.

2. *Lake Tahoe.* The regulations state that all storage facilities on the upper Truckee River are to be operated in accordance with the Floriston rates and existing decrees with the goal of maximizing storage at Stampede Reservoir. In addition, the regulations provide specifically that Lake Tahoe's operation should be coordinated with the operation of Stampede Reservoir.

3. *Prosser Reservoir.* Prosser Reservoir is also to be coordinated with Stampede and operated in accordance with Floriston rates and existing decrees to maximize storage at Stampede.

4. *Boca Reservoir.* Boca Reservoir should be operated the same as Prosser Reservoir and Lake Tahoe.

5. *Stampede Reservoir.* Generally, the regulations provide that Stampede is to be operated to provide flood control, to enhance fish and wildlife and recreation benefits, and to store water for possible agricultural use by TCID. Stampede's operation is to be coordinated with that of Lake Tahoe, Prosser Reservoir, and Boca Reservoir, consistent with existing decrees and the Floriston rates. The regulations require maximum storage in Stampede. To enhance Stampede's storage, TCID is given storage credit in Stampede in lieu of water diverted into Lahontan Reservoir. TCID was to receive an initial storage credit (from Feb. 1, 1974) of 50,000 acre-feet, and additional credit of any storage beyond 127,600 acre-feet. This water would then be available for release from Stampede and diversion by TCID whenever storage in

Lahontan Reservoir drops below 80,000 acre-feet. Otherwise, TCID must accept credit in lieu of making diversions. The combined amount of actual storage in Lahontan and storage credit in Stampede is not to exceed 317,300 acre-feet. If that limit is exceeded, storage credit is reduced accordingly.

In addition, Stampede is to be operated with the objective of maintaining certain minimum flow rates in the Truckee River below Derby Dam; 600 cfs from March 1 through May 15, 300 cfs from May 16 through September 15, and 150 cfs from September 16 through February 28. Finally, at the end of the water year, TCID would receive "carry-over" storage credit for the amount of water it could have diverted to Lahontan without the storage credit system. Any other water remaining in Stampede at the end of the water year would be allocated either for releases to Pyramid Lake or for additional carryover credit by the Secretary of the Interior after consultation with the Tribe and the U. S. Fish and Wildlife Service.

Flows.

6. *Floriston Rates*. The regulations repeatedly state that actions taken are to be "consistent with" the Floriston rates.

Diversions.

7. *Truckee Canal*. The regulations limit TCID's Newlands Project diversion from both the Truckee and Carson Rivers to 288,129 acre-feet for the water year. Moreover, diversions through the Truckee Canal are to be minimized and the use of Carson River water is to be maximized. Diversions are permitted according to the regulations given in the previous table. The amount which can be diverted between November and March depends upon the accumulated precipitation at Tahoe City. Between April and October the amount depends on the extent of forecasted runoff plus existing storage. Throughout the year the right to divert arises only when the level of Lahontan Reservoir reaches a "lower limit", as set forth in the table, and continues only until the lake reaches an "upper limit". In no case can change in the flow in the Truckee Canal exceed 50 cfs or 20 percent of the flow in the Truckee River, whichever is greater.

The net impact of the regulations would be to significantly reduce diversions below historical levels. However, the regulations permit diversions through the canal of water released from Stampede whenever the level of Lahontan Reservoir is at or below 4,129.28 feet in elevation (80,000 acre-feet) during the irrigation season. Such diversions are limited to the lesser of TCID's credited storage or the amount needed to meet remaining seasonal agricultural requirements.

8. *Pyramid Lake Indian Reservation.* The entire set of regulations was promulgated for the purpose of getting more water into Pyramid Lake. The regulations expressly state that "the Court declares that (these operating criteria) are necessary and appropriate to fulfill the Secretary's fiduciary and legal obligation to the Tribe".

9. *SPPCo (Reno-Sparks M&I Water).* SPPCo's diversion rights would not be directly affected by the DOI regulations.

Current Litigation and Other Actions.[11]

Water Bodies.

1. *Lahontan Reservoir.* The operation of Lahontan Reservoir will be affected by the outcome of the TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe of Indians litigation. (See sub Appendix C-1). If the government and Tribe win that lawsuit, the reservoir will be operated according to the Department of the Interior regulations discussed above. If the plaintiff, TCID, wins, the regulations will not be enforced and Lahontan Reservoir will probably be operated according to TCID's discretion. In addition, the reservoir's operation relative to Truckee River water will be impacted by the rights to be decreed in U.S. v. Alpine Land and Reservoir Co. In that adjudication, the U.S. is asking that the Newlands Project be served primarily by Carson River water rather than Truckee River water; TCID is opposed to this limitation.

2. *Lake Tahoe.* Although there is no current litigation directly affecting Lake Tahoe's operation as a reservoir, it is, of course, indirectly impacted by all challenges to Newlands Project operation, and other Truckee River matters. The same is true of Prosser and Boca Reservoirs.

3. *Prosser Reservoir.* See Number 2 above.

4. *Boca Reservoir.* See Number 2 above.

5. *Stampede Reservoir.* The operation of Stampede Reservoir is indirectly at issue in the TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe of Indians case. (See sub Appendix C-1). If the government and Tribe win, Stampede will be operated (or continue to be operated) in large part to maintain fish flows in the Truckee River, as provided in the Department of the Interior regulations. If TCID wins, the regulations would not be applied to Stampede's operation. Stampede's operation is directly at issue in Carson-Truckee Water Conservancy District v. Andrus. (See sub Appendix C-1). If the District is successful in this suit, it could force the Secretary to allocate some of Stampede's water to municipal uses in the Reno area. If the defendant wins, Stampede would probably continue to be operated primarily for fishery maintenance and flood control purposes.

6. *Floriston Rates.* There is no direct impact on the Floriston rates contemplated by any of the current actions. However, the eventual outcome of the FERC case, (sub Appendix C-1) could impact the rates.

7. *Truckee Canal.* Truckee Canal diversions will be impacted by the outcome of all three major ongoing cases. If the government and the Tribe win in U.S. v. TCID and/or TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe of Indians, canal diversions will be severely limited. The first suit would give the Indians a right to some minimum flow in the Truckee River, at least 40 cfs near Marble Bluff Dam, and probably about 385,000 acre-feet inflow into Pyramid Lake. The second suit would maximize river flow and minimize diversions according to the Department of the Interior Regulations. If these suits are won by TCID, Truckee Canal diversions would probably remain near their historical level, irrespective of minimum river flow or lake inflow. Finally, the outcome of Alpine will determine generally whether diversions will be decreased.

8. *Pyramid Lake Indian Reservation.* By petition under the Orr Ditch Decree, the Tribe is requesting flexibility in use of their decreed agricultural water rights to allow them to keep some of the water (about 40 cfs) in the river for fishery maintenance purposes. The water would be used primarily to operate the Marble Bluff fishway. If the petition is unsuccessful, the Tribe's right would be available for agricultural purposes only.

In addition, the outcome of the U.S. v. TCID lawsuit will impact the reservation. If the defendants win, the reservation's water right would be limited to the amounts decreed in Orr Ditch for agricultural uses. If the government and Tribe win, the reservation could obtain a water right to enough Truckee River flow into Pyramid Lake to keep the lake at its current level (about 385,000 acre-feet annual inflow).

9. *SPPCo (Reno-Sparks M&I Water.* SPPCo's diversion rights would not be directly affected by current lawsuits. However, Reno-Sparks M&I water supply will be affected by the outcome of CTWCD v. Andrus (see sub Appendix C-1). This case will determine whether the cities will obtain any water from Stampede Reservoir for M&I purposes.

Conclusion

It is impossible to draw precise conclusions on the impacts of the Master Project alternatives on the legal and institutional environment of the Truckee River. It is equally difficult to predict the environment's impact on the project and to utilize the contextual information as an aid in project evaluation and decision-making. The most that can be said with confidence is that water rights and water allocation on the Truckee River will remain disputed and highly uncertain for at least the next several years. During this time, major decisions will be made concerning such important questions as: whether the Pyramid Lake Paiute Indian Reservation has a water right to preserve the Pyramid Lake-Truckee River fishery; whether the Department of Interior may limit Newlands Project diversions and specify project operating procedures (and perhaps even take over operation); whether private power-related facilities on the Truckee River will require federal licenses and what the consequences of federal licensing would be; and what the effects will be of the Endangered Species Act on at least one federal facility in the Truckee River.

With unknown variables of such great proportions, the impacts of the Master Project alternatives cannot be clearly specified. However, the project planners and decision makers must at least identify the complexities and uncertainties, and allow for the various contingencies as much as possible.

Several Master Project alternatives require water and water rights beyond what the cities and their water supplier now own. The project planners must therefore explore all possible means of water and water rights acquisition delineated in this report. This includes transfers through purchase and condemnation, and changes in place and purpose of use, both under state and federal procedures. The parties available as potential transferers include all the water rights holders identified here, such as federal agencies and private parties. At the same time, the planners must clearly identify the constraints limiting their actions. These constraints may consist of statutory requirements, such as the ESA, or they may consist of voluntary blocks to acquiring water rights, such as a refusal by the Paiutes to transfer either their agricultural water rights (for use in land disposal) or any fishery rights they might obtain.

It is possible that once EPA, as the author of the JWPCP Master Project EIS, has identified all these seemingly insurmountable barriers, the problems will have to be solved by some mechanism beyond the EIS process. Perhaps the Department of Interior or Congress will recognize the seriousness of Truckee River environmental problems and water disputes and begin to fashion an equitable and workable management plan. Although such a development might frustrate those for whom the EIS is supposed to provide guidance and answers, it certainly would not be a small accomplishment.

FOOTNOTES

[1] For further discussion of transfers in relation to the JWPCP, see University of Nevada Desert Research Institute and Walters Engineering, "Institutional Constraint Evaluation of Land Application Sites and Water Right Availability for Reno-Sparks Sewage Effluent," January 1979.

[2] The Federal Energy Regulatory Commission has declared the Truckee River to be navigable. However, the Commission's decision is being appealed. (See sub Appendix C-1)

[3] See Solicitor General's Opinion #M-36914, "Federal Water Rights of the National Park Service, Bureau of Reclamation, and the Bureau of Land Management," June 25, 1979.

[4] The Sierra Valley case was an adjudication on the Little Truckee River. The final decree, October 24, 1958, was based on a stipulation among the U.S., Sierra Valley Water Co., WCWCD, and SPPCo. It gave Sierra Valley a right to divert a maximum of 60 cfs from the Little Truckee during irrigation season. The priority is 1870; the right is subject to certain conditions, including a release of 3 cfs during the summer and 5 cfs during the winter as minimum flows in the Little Truckee for fishery purposes.

[5] The Fish and Wildlife Service conducts the consultations and issues opinions on behalf of the Secretary of the Interior.

[6] Section 9 of the Act (16 U.S.C. §1538) addresses some behavior of "any person," concerning such activities as importing or exporting endangered species.

[7] In addition, another project has recently come up for an exemption, but is being litigated on a procedural point and hence has not completed the process. (Pittston Oil Refining Co. v. ESC, No. 79-1779 (D.D.C. 1979.)

[8] The State of Nevada has petitioned to remove the Lahontan cutthroat trout from the threatened species list, but at this time it remains listed. At one time,

the cutthroat was listed as endangered, but its status was changed when some reestablishment occurred.

[9] The Secretary of the Interior rejected a proposal by the Fish and Wildlife Service in August 1978, to designate the lower Truckee River (Derby Dam to Pyramid Lake) as critical habitat for the cui-ui. However, such a designation could be made at any time. In order to classify an area as a critical habitat, the Secretary would have to determine (a) for an area inside the species' geographical range: that it contained physical or biological features which are essential to species preservation and which may require special management or protection and (b) for an area outside the geographical range: that it was essential to species conservation. (ESA §3 [5], 16 U.S.C. §1532 [5]). For example, the Secretary could conceivably designate the entire Truckee River watershed as critical habitat for the cui-ui if he determined that water quality and quantity control throughout the whole system was essential to species conservation. However, the Secretary *is* directed to consider economic and other impacts of a designation, and he may exclude areas if the benefits of exclusion outweigh the benefits of inclusion, unless exclusion will result in species extinction. (ESA §4 [b] [4], 16 U.S.C. §1533 [b] [4]).

[10] Nevada does not yet have a federally-approved program of water quality standards for administering its NPDES permits. The JWPCP currently operates under an interim discharge permit issued by the state.

[11] See Case Briefs in sub Appendix C-1 for more complete discussion.

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SUBAPPENDIX C-1

Case Briefs Affecting Water in the Truckee River Basin

Case Briefs: Completed Actions

FULL NAME	United States v. Truckee River General Electric Company.
SHORT OR COMMON NAME	"Lake Tahoe Decree"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	No. 14861. Northern District of California, 2nd Division.
PARTIES	Plaintiff: United States. Defendant: Truckee River General Electric Company, predecessor in interest to Sierra Pacific Power Company.
PROCEDURAL HISTORY	Filed: 1909. Decided: June 28, 1915, by issuance of a consent decree.

CASE SUMMARY

In 1909, the federal government brought a condemnation action against the Truckee River General Electric Company. The suit was brought under the 1902 Reclamation Act to obtain title for the Newlands Project to a dam the company owned and operated at the outlet of Lake Tahoe. The dam had been built in 1870 by lumbering interests and was acquired by Truckee River GE in 1908 along with a 54-acre tract of land.

On June 28, 1915, the litigation was settled by a consent decree. The decree gave the government "perpetual easement and right of exclusive possession and enjoyment" to the dam and 14 adjacent acres. The company kept 40 acres and bare legal title to the 14 acres. The company also got the right to have certain minimum flows maintained in the river by lake releases to operate its power plants. These rates were 500 cfs from March 1 to September 30 and 400 cfs from October 1 to the end of February; they were to be measured at Iceland Gage near Floriston, California. The rates are known as the Floriston Rates. In addition, the decree set the storage capacity of Lake Tahoe at 732,000 acre feet.

Additional Comments. In 1926, the operation of the Lake Tahoe dam was turned over to TCID by a contract with the Department of the Interior which provided for TCID's operation of all Newlands Project facilities.

In 1935, the Floriston Rates were modified by the Truckee River Agreement, which became part of the Orr Ditch Decree. The rates were changed to 350 cfs between November 1 and March 31 when Lake Tahoe is between 6225.25 and 6226.0 feet in elevation and 300 cfs when the lake is below 6225.25 feet in elevation. (The 1915 Lake Tahoe Decree (except for the Floriston Rates) was to be unaffected by the Orr Ditch final decree.)

FULL NAME	
SHORT OR COMMON NAME	"Price Decree"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	
PARTIES	
PROCEDURAL HISTORY	Decree entered December 10, 1921.
CASE SUMMARY	Complete information on this case and decree was unavailable at the time of this writing. The adjudication took place pursuant to the provisions of the California Water Commission Act and the decree established the rights to use of water from the West Fork of the Carson River in California.

FULL NAME
United States v. Orr Ditch Water Company, et. al.
and Truckee River Agreement

SHORT OR COMMON NAME
"Orr Ditch Decree" or "Truckee River Decree" and "TRA"

CITATION AND/OR DOCKET NUMBER; COURT; JUDGE
Equity No. A-3 (1944).
Nevada Federal District Court.
Judge Frank H. Norcross.

PARTIES
Plaintiff: United States
Defendants: Over 800 water users and rights holders on the Truckee River (including Sierra Pacific Power Company, Washoe County Water Conservation District, and the City of Reno).

PROCEDURAL HISTORY
Filed March 3, 1913.
Truckee River Agreement signed by major parties July 1, 1935.
Final Decree entered Sept. 8, 1944.

CASE SUMMARY

In 1913, the federal government filed this quiet title action in Nevada federal district court against Truckee River water users. The purpose of the action was to assure an adequate water supply to operate the Bureau of Reclamation's Newlands Project. The United States claimed an appropriative water right with a July 2, 1902 priority to divert water through the Truckee Canal for Newlands Project irrigation. The government also claimed, on behalf of the Pyramid Lake Indian Reservation, Winters Doctrine irrigation water rights for reservation lands with Dec. 8, 1859 priorities. In addition, the U.S. claimed a storage water right for Lake Tahoe with a priority date of May 21, 1903.

The Orr Ditch litigation had been going on for about 20 years when the four major parties signed the Truckee River Agreement, which laid the foundation for a final decree. (See "additional comments" to this brief, page 32 infra.)

The final decree in this case was entered on September 8, 1944. The decree specified the water rights of the U.S. and the defendants. The government obtained a right to divert 1500 cfs of water at Derby Dam for transport through the Truckee Canal to irrigate Newlands Project lands. The government's rights held on behalf of the Indian Reservation were decreed at a maximum of 14,742 acre feet to be diverted through Indian Ditch for irrigation of 3130 acres of bottom land and a maximum of 15,345 acre feet to be diverted through any ditch for irrigation of 2745 acres of bench land.

The Lake Tahoe right was decreed to entitle the government to an inflow and outflow of 3000 cfs. (This amount was somewhat modified by the Truckee River Agreement; see page 109 infra.) The Decree also gave the U.S. the right to operate Lake Tahoe according to the provisions of the 1915 Lake Tahoe Decree (see discussion at page 28 supra), particularly to discharge enough water from the lake to deliver 1500 cfs of water to the

Truckee Canal. (The U.S.'s rights are shown at pages 10-11 of the Orr Ditch decree. See further details of the government's rights in the chart at pages 106 through 121 infra.)

The final decree also decreed rights for the many defendants. This included rights to Sierra Pacific Power Company for power generation diversions for five power plants: the Farad plant (enough water to deliver 325 cfs, 1899 priority, and 75 cfs, 1906 priority); the Fleish plant (enough water to deliver 327 cfs; priority Feb. 16, 1904); the Verdi plant (enough water to deliver 399 cfs; priority Oct. 21, 1909); the Washoe plant (enough water to deliver 396 cfs; priority Oct. 27, 1902); and the now-defunct Reno plant (enough water to deliver 250 cfs, priority Mar. 31, 1891; and 46 cfs, priority Nov. 1, 1909). In addition, Sierra Pacific was given rights to divert (1) 5.5 cfs through Verdi Ditch for irrigation along the Katz Ditch, (2) 100 miner's inches through Verdi Ditch for supplying the Verdi Lumber Company in its logging and sawmill operation, and (3) 50 miner's inches through the Reno Ditch to supply several individual defendants with irrigation water. Sierra Pacific was also decreed the right, during the irrigation season, to use .31 cfs of the Washoe Ditch water for irrigation of 12.4 acres of its land up to a maximum of 50 acre feet per season, and the right to deliver 1.25 cfs of the Washoe water to an individual defendant for his irrigation use, up to a seasonal maximum of 257 acre feet. The priorities for the additional rights are May 1, 1872 and April 1, 1914 for the Katz Ditch water, 1894 for the Verdi Lumber Company water, and Dec. 20, 1871 for the Reno Ditch water. Further, Sierra Pacific was decreed rights to divert water from Hunter Creek (about 13.6 cfs) and through Highland Ditch (40 cfs) for supplying the cities of Reno and Sparks and providing irrigation water to a number of individuals. (Sierra Pacific's rights are shown at pages 11-12 of the decree.)

The decree also provided rights to the Riverside Mill Company and the Wadsworth Light and Power Company for 70 cfs (priority May, 1863) and 34.43 cfs (priority June 26, 1897) respectively. Finally, the decree lists irrigation rights for the hundreds of additional defendants.

There are several general provisions of the decree which apply to some or all of the parties.[1] For example, any diverters of water for power generation, milling, or municipal purposes are entitled to divert as much as an additional 20% of the amount of any ditch's total allowable diversion to flush ice from their ditches. All power generation water, milling water, or ice flushing water must be returned to the river after use.

The amounts of water allowed by the decree depend somewhat on the type of crop being irrigated. Thus, if grain is being grown, only 2/3 of the amount specified is allowed. If the crop is potatoes, corn, or beets, only 4/5 is allowed, and if the crop is young alfalfa

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[1] Only certain major provisions are discussed here.

(the first year), an additional 10% is allowed.

The quantities of water decreed are for the calendar year unless specified otherwise; however, no irrigator may use during any calendar month more than 25% of the total amount allowed for the season. Any diverter may divert enough water to cover transportation losses and deliver to his land the full decreed amount; in other words, the water duty is the controlling amount. However, no one may divert extra water for ditch regulation if he thereby deprives someone else of water he is entitled to.

The decree requires *reasonable*, beneficial use and prohibits wasteful or excessive use of water. The decree also provides that those whose rights were adjudicated by the decree are entitled to change "the point of diversion and the place, means, manner, or purpose of use" of their waters "in the manner provided by law." Finally, the decree incorporates the Truckee River Agreement (see additional comments, below) and the 1915 Lake Tahoe Decree (see page 28 *supra*) as part of this final decree.

Additional Comments. The major factor leading to the issuance of a final decree in this case was the signing of the Truckee River Agreement (TRA) on July 1, 1935. The agreement was signed by the United States, TCID, SPPCo, WCWCD, and additional parties, all of whom together accounted for over 70% of Truckee River water use. The agreement is a complex document regulating flows, reservoir operations, and diversions in the river. Some details of pertinent provisions appear in the chart at pages 106 through 121 *supra*. Basically, the agreement provided for the construction of storage facilities on the river and then gave rights to various parties to use this stored water under certain conditions. The TRA provided that the U.S. (by agreement with WCWCD) would construct a reservoir with a capacity of at least 40,000 acre feet. The agreement also provided that SPPCo would construct "pondage" of 800 acre feet. Both sources were to help maintain the Floriston Rates, especially during the summer. The two facilities were eventually combined in the construction of Boca Reservoir, with a capacity of 40,900 acre feet. Boca's operation, as well as that of Lake Tahoe, was made subject to a series of directives in the agreement (see pages 110 through 112, for example).

The TRA also allocated the "diverted flow" of the Truckee among (1) TCID (for the Carson and Truckee divisions of the Newlands Project) and SPPCo (the 40 cfs for supplying Reno) (31%) and (2) WCWCD and others (those entitled to water use between Iceland Gage and Derby Dam by the Orr Ditch Decree) (69%). This diverted flow consists of the total of all power company diversions (the 40 cfs allowed to be diverted at Highland Ditch) and irrigation diversions all the way downstream *to* Derby Dam *minus* 1) the irrigation diversions downstream *of* Derby Dam and 2) any privately owned stored water (unless it has been used to maintain Floriston Rates) and 3) any natural flow* in excess of the Floriston Rates.

*See note on next page.

The significance of this allocation was to guarantee certain flows to downstream diverters, and to provide that these rights could be met by water stored upstream.

Beyond the basic division, there are several conditions on the use of the two percentages. If SPPCo cannot obtain its full 40 cfs for supplying Reno from the 31% of diverted flow, it may take the necessary amount from the other parties' 69%. (If this still is not enough, SPPCo may divert as much "Truckee Canal" water*/ as it needs to get 40 cfs.) Subject to that right, WCWCD is entitled to all the water within the 69% which is in excess of natural flow. If this right is not fully exercised, TCID may divert any excess which reaches Derby Dam. Finally, WCWCD may use its share on additional lands only if they are within the district boundary and contiguous to lands with water rights from the Orr Ditch Decree, provided that the total area of these additional lands does not exceed 5% of the total area between Iceland Gage and Derby Dam entitled to Truckee River water use under the Orr Ditch decree. Other impacts of the TRA are discussed at pages 109 through 115 *infra*.

Two petitions have been filed in regard to the Orr Ditch Decree. In 1976, the Water Master in charge of administering the decree, Claude Dukes, filed a petition in federal court asking for guidance on how to administer the decree and operate the river. (See page 62 *infra*.) In 1979, the Pyramid Lake Paiute Tribe filed a petition in federal court requesting a change in their decreed right to allow it to be used for fishery maintenance rather than irrigation. (See page 64 *infra*.)

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*Both *Natural Flow* and *Truckee Canal Water* are defined at page 111 *infra*.

FULL NAME	Prosser Creek Reservoir Agreement "(1959)"
SHORT OR COMMON NAME	None
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	N/A
PARTIES	N/A
PROCEDURAL HISTORY	N/A
CASE SUMMARY	Complete information on this agreement was unavailable at the time of this writing. Briefly, the agreement was entered into among the United States, Washoe County Water Conservation District, Sierra Pacific Power Company, and Truckee-Carson Irrigation District. The purpose of the agreement was to provide for the construction, operation, and maintenance of the Prosser Creek Dam and Reservoir. In addition, the agreement was to provide for the coordination of the reservoir's operation with that of Lake Tahoe, particularly in regard to maintaining the Floriston Rates. (See pp. 107-121 *infra*.)

FULL NAME	*United States v. Nevada and California*
SHORT OR COMMON NAME	None
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	412 U.S. 534, 93 S.Ct. 2763, 37 L.Ed. 132 (1973), No. 59, Orig. United States Supreme Court. Per curiam.*/
PARTIES	Plaintiff: United States. Defendants: States of Nevada and California.
PROCEDURAL HISTORY	Filed: Sept., 1972. Decided: June 11, 1973.
CASE SUMMARY	In September of 1972, the federal government filed a request for permission to file a complaint pursuant to the Supreme Court's original jurisdiction statute (28 U.S.C. §1251). The purpose of the complaint was to obtain a declaration of the rights of the U.S. and the states of Nevada and California in the waters of the Truckee River. Particularly, the complaint asked for a declaration that the government holds a water right for the Pyramid Lake Reservation with an 1859 priority date to maintain Pyramid Lake at its current level. The Court denied the government's motion, noting that it had original but not exclusive jurisdiction over the matter. The Court reasoned that there was no controversy between the two states,**/ and that there was no immediate controversy between the U.S. and California, so the dispute was essentially one between the U.S. and Nevada. The opinion suggested that Nevada federal court was the most appropriate forum for the case, and declined to exercise original jurisdiction "to settle competing claims to water within a single state." *Additional Comments*. In response to this decision, the federal government filed suit in Reno federal district court (*U.S. and Pyramid Lake Paiute Tribe v. TCID, et al.*; see discussion at page 50 *infra*).

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*/Per curiam: an opinion of the entire court rather than one written by a single judge.

**The Court's reasoning on this ground was based on the fact that the two states had agreed on the proposed Interstate Compact. (See page 89 *infra*.)

FULL NAME	Pyramid Lake Paiute Tribe of Indians v. Morton
SHORT OR COMMON NAME	"The Gesell Decision"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	354 F. Supp. 252 (D.D.C.1972). Civ. A. No. 2506-70. Federal District Court, District of Columbia. Judge Gerhard Gesell.
PARTIES	Plaintiff: Pyramid Lake Paiute Tribe. Defendant: Secretary of the Interior Rogers Morton.
PROCEDURAL HISTORY	Filed: Aug. 21, 1970. Decided: Nov. 8, 1972. Amended: Nov. 29, 1972. Supplemental opinion: Feb. 20, 1973. No appeals.

CASE SUMMARY

In 1967, the Secretary of the Interior published general regulations governing the operation of reclamation projects and other federal units on the Truckee and Carson Rivers. (See 43 C.F.R.418.) To implement those general regulations, the Secretary issued specific regulations governing yearly diversions from the Truckee River at Derby Dam by TCID, which operates Derby Dam and the rest of the Newlands Reclamation Project under a 1926 contract with the Secretary. This lawsuit was brought by the Pyramid Lake Paiute Tribe to challenge the regulation issued for the 1972-73 water year, which allowed a diversion of 378,000 acre-feet. (37 Fed. Reg. 19838.)

Judge Gerhard Gesell held that the regulation was arbitrary and capricious and an abuse of discretion by the Secretary because it disregarded interrelated court decrees allocating water in the area, and that it violated the Secretary's trust obligation to the Tribe and thus unlawfully withheld required action to the Indians by not preserving more water for Pyramid Lake. Gesell therefore set aside the regulation and directed the Secretary to submit an amended regulation for the court's approval. The court eventually adopted an order which allowed a diversion of 350,000 acre-feet the first year and 288,129 acre-feet annually after that and specified additional requirements for the use of Truckee and Carson River water in the Newlands Project. These requirements were then adopted and published as Interior Department regulations at 38 Fed. Reg. 6697-6700 on March 12, 1973. (See full text of court's order and Interior's regulations reproduced below.)

Issues and Legal Theories. The main issue in this case was whether the regulation allowing TCID to divert 378,000 acre-feet of water at Derby Dam was arbitrary, capricious, or an abuse of discretion by the Secretary of the Interior, thereby violating the Administrative Procedure Act (5 U.S.C. §706). In addition, there was a question as to whether the Secretary of the Interior had unlawfully withheld or unreasonably delayed required actions under the Administrative Procedure Act.

The Tribe contended that the regulation violated the A.P.A. because it delivered more water to TCID than the District required and improperly diverted water that otherwise would flow into Pyramid Lake. The theories behind these challenges were that the Secretary had ignored his own guidelines governing TCID's water use as well as applicable contract provisions and court decrees (Orr Ditch and Alpine), and that the Secretary had violated his trust responsibilities to the Tribe. It appears that the Secretary's contention was that, acting in good faith, he had resolved a number of conflicting requirements and recommendations with a "judgment call," attempting to accommodate all interests.

Results and Consequences. Judge Gesell recognized that the Secretary had acted in good faith but determined that there was no justification for the number chosen in light of all the conflicting factors and therefore his "judgment call" was arbitrary. Furthermore, since the Tribe had initiated this suit asserting "well-founded rights" to additional flow to Pyramid Lake, it was a violation of the Secretary's fiduciary duty to the Tribe and "unlawfully withheld action" not to justify precisely any diversion of otherwise uncommitted water. Judge Gesell determined that the Secretary had an affirmative duty to enforce contract provisions against water waste and to incorporate in the regulation both applicable court decrees, one of which (Alpine Decree) provided a lesser amount of water for some of TCID's lands. Therefore, Judge Gesell suspended the Secretary's regulation and directed that a new one be formulated. He instructed the Secretary to consider both the Orr Ditch and Alpine Decrees, to minimize waste, to end delivery of water that TCID was not entitled to, and to insure TCID's compliance. In addition, Gesell noted that the Secretary's operation of Stampede Reservoir, upstream of Derby Dam, also had to give paramount importance to his trust obligations to the Tribe. Finally, the judge insisted that the Secretary justify any regulation which did not provide at least 385,000 acre feet of flow to Pyramid Lake.

The amended regulation was adopted by the court on Feb. 20, 1973. The full text of the court order is reproduced below:

JUDGMENT AND ORDER

The Court having filed its Memorandum Opinion of November 8, 1972, after giving full opportunity to the parties to fashion appropriate relief and having considered the proposed relief of each party, it is hereby

Ordered, adjudged and decreed that:

(1) The Secretary's Operating Criteria setting forth procedures for coordinating operation and control of the Truckee and Carson Rivers to provide service to the Newlands Project now in effect are arbitrary and an abuse of his discretion.

(2) The Court declares that Operating Criteria in the form attached to this Judgment and Order are necessary and appropriate to fulfill the Secretary's fiduciary and legal obligations to the Tribe.

(3) The Secretary shall immediately publish this Judgment and Order, and publish and implement and enforce the attached Operating Criteria for the water year commencing November 1, 1973, and for the current water year ending October 31, 1973, provided, however, for the current water year only, he may divert up to 350,000 acre-feet for the twelve months ending October 31, 1973, and he shall disregard the detailed provisions of Sections A and B and in lieu thereof comply with the following requirements:

A(1) 50,000 acre-feet of water presently stored in Stampede Reservoir will be credited to the Truckee-Carson Irrigation District to be used by it in the event the water stored in Lahontan Reservoir shall fall below 20,000 acre-feet and it appears that it is necessary to draw upon this water to meet the needs within the allowable maximum total diversion of the Truckee-Carson Irrigation District for this water year.

(2) Subject to the provisions of Section A(1), diversions from the Truckee River for the Truckee-Carson Irrigation District shall be limited to the needs of the Truckee division.

(3) Maximum storage of water in Stampede Reservoir shall be required. Releases shall be limited insofar as possible consistent with existing decrees, flood control requirements and for the purposes of assisting fishery experiments as approved by the Secretary after consultation with the Tribe and the Bureau of Sport Fisheries and Wildlife.

(4) Nothing in this Judgment and Order shall constitute an interpretation or modification of either the Alpine or Orr Water Ditch decrees, nor shall it be deemed to affect the rights of any person under either of such decrees, so long as they remain in effect.

(5) Nothing in the Judgment and Order shall be deemed to prevent any change in the Operating Criteria that may be agreed between the parties, in writing, or ordered by the Court, after notice.

OPERATING CRITERIA AND PROCEDURES FOR COORDINATED OPERATION AND CONTROL OF THE TRUCKEE AND CARSON RIVERS FOR SERVICE TO NEWLANDS PROJECT

The water supply diversions to the Truckee-Carson Irrigation District from both the Truckee and Carson Rivers shall be limited to the amount needed for agricultural purposes, not exceeding 288,129 acre-feet, if available, for the twelve months ending October 31, 1974. The water supply diversions shall be measured at the gauging station below Lahontan Dam and at diversion points along the Truckee Canal.

All use of water for power generation shall be incidental to either agricultural use or precautionary drawdown or spill.

In satisfying the diversion for agricultural purposes, maximum use will be made of Carson River water and diversions through the Truckee Canal will be minimized.

Stampede Reservoir shall be operated by the United States to provide flood control, fish and wildlife, and recreation benefits and to store water for possible agricultural use by the Truckee-Carson Irrigation District. The operation of Stampede Reservoir will be coordinated with the operation of Lake Tahoe, Prosser Creek Reservoir, and Boca Reservoir to avoid infringing upon the Floristan Rates or water rights established by existing degrees and agreements.

In all of the operations, Truckee Canal will be operated to the maximum extent practical with the objective of maintaining minimum terminal flow to Lahontan Reservoir or Carson River during all periods except when criteria herein specifically permits such deliveries. In order to minimize the rates of fluctuation in the Truckee River below Derby Dam the change of flow in Truckee Canal within any 24-hour period shall not exceed 50 cubic feet per second or 20 percent of the flow in the Truckee River below Derby, whichever is greater.

During periods of spill or precautionary drawdown of Lahontan Reservoir, the District will be charged only with the predetermined schedule of irrigation releases to be passed at the gauging station below Lahontan Reservoir plus measured diversions from the Truckee Canal and Rock Dam Ditch.

The operation of Stampede Reservoir, Derby Diversion Dam, Truckee Canal, and Lahontan Reservoir will be conducted in accordance with the following criteria in order to minimize diversions from the Truckee River through the Truckee Canal.

SECTION A
Truckee Diversion Criteria

Subject to conditions specified in Section B (Storage Credit at Stampede), the diversions of water from the Truckee River into and through the Truckee Canal will be governed by the following criteria:

(1) If available, sufficient water will be diverted into Truckee Canal to meet direct agricultural requirements along the Truckee Canal.

(2) Diversions through the Truckee Canal into Lahontan Reservoir will be made in accordance with the following tabulation:

Operating month	If accumulated precipitation from Oct. 1 to date at Tahoe City, Calif. is:		Continue Truckee Canal Diversion to Lahontan Reservoir if storage is less than upper limit			
			Lower limit[1]		Upper limit	
November-March		Inches	Elev.	Ac.Ft.	Elev.	Ac.Ft.
November 1	Less than	5.00	4123.3	60,000	4124.3	63,000
	Equal or Greater than	5.00	4103.6	20,000	4105.8	23,000
December 1	Less than	5.00	4129.3	80,000	4130.1	83,000
	Between	5.00 & 10.70	4123.3	60,000	4124.3	63,000
	Greater than	10.70	4115.4	40,000	4116.8	43,000
January 1	Less than	10.70	4138.5	120,000	4139.1	123,000
	Between	10.70 & 16.80	4131.8	90,000	4132.6	93,000
	Greater than	16.80	4123.3	60,000	4124.3	63,000
February 1	Less than	16.80	4145.8	160,000	4146.3	163,000
	Between	16.80 & 22.10	4138.5	120,000	4139.1	123,000
	Greater than	22.10	4129.3	80,000	4130.1	83,000
March 1	Less than	22.10	4151.8	200,000	4152.2	203,000
	Between	22.10 & 26.10	4144.1	150,000	4144.6	153,000
	Greater than	26.10	4134.2	100,000	4134.9	103,000
	If forecasted runoff plus existing storage on April 1 is:					
April-October		Ac.Ft.	Elev.	Ac.Ft.	Elev.	Ac.Ft.
April 1	Greater than	350,000	No diversion to Lahontan thru October			
	Between	250,000 & 350,000	4154.3	220,000	4156.7	223,000
	Less than	250,000	4159.8	270,000	4160.1	273,000
May 1	Between	250,000 & 350,000	4151.8	200,000	4152.2	203,000
	Less than	250,000	4162.6	300,000	4162.8	303,000
June 1	Between	250,000 & 350,000	4144.1	150,000	4144.6	153,000
	Less than	250,000	4157.7	250,000	4158.1	253,000
July 1	Between	250,000 & 350,000	4134.2	100,000	4134.9	103,000
	Less than	250,000	4145.8	160,000	4146.3	163,000
August 1	Between	250,000 & 350,000	4129.3	80,000	4130.1	83,000
	Less than	250,000	4131.8	90,000	4132.6	93,000
Sept 1	Less than	350,000	4119.7	50,000	4120.8	53,000
October 1	Less than	350,000	4115.4	40,000	4116.8	43,000

[1] Truckee Canal Diversion to Lahontan Reservoir should be started only when storage recedes below lower limit.

SECTION B
Storage Credit at Stampede

As a means of minimizing the diversions of Truckee River water for use on the Carson Division of the Truckee-Carson Irrigation District or for storage in Lahontan Reservoir and at the same time ensuring that the District shall receive exactly the same total amount of water for its beneficial use as otherwise, the following modifications shall be applied to the criteria in Section A (Truckee Diversion Criteria):

(1) The storage levels in Lahontan Reservoir specified as limits for starting and stopping diversions of water for storage in Lahontan or use on the Carson Division shall be converted to acre-feet and applied to the sum of water in storage at Lahontan Reservoir and water in Stampede Reservoir credited to the Truckee-Carson Irrigation District using the most up-to-date area-capacity curve for each reservoir.

(2) The combined storage facilities on the upper Truckee River will be operated in a manner consistent with the applicable decrees and so as to maintain the Floristan Rates with the objective of maximizing the accumulation of storage in Stampede Reservoir.

(3) Whenever there is an adequate amount of uncommitted water in Stampede Reservoir the Truckee-Carson Irrigation District shall forego the diversion of water into the Truckee Canal for storage in Lahontan Reservoir or for use on the Carson Division and shall accept credit in Stampede Reservoir for the amount of water it otherwise would have diverted. For the purposes of this subsection, an adequate amount of uncommitted water (consisting of not less than 50,000 acre-feet) will be deemed to have accumulated in Stampede Reservoir no later than February 1, 1974.

(4) The sum of the amount of water stored in Lahontan Reservoir plus the amount of water stored in Stampede Reservoir and credited to the Truckee-Carson Irrigation District shall not be allowed to exceed the storage capacity of Lahontan Reservoir below elevation 4163.67 feet above mean sea level (317,300 acre-feet), and this limit shall be preserved, if necessary, by the reduction of credit in Stampede Reservoir. When the amount of water credited to the Truckee-Carson Irrigation District is so reduced, the amount of that reduction shall be credited for the purpose of maintaining the minimum rates of flow below Derby Dam provided in Section B(7) of these Operating Criteria and Procedures.

(5) Whenever the water surface elevation of Lahontan Reservoir is at or below elevation 4129.28 feet (80,000 acre-feet) above mean sea level during the irrigation season, water will be released from Stampede Reservoir to be diverted into and through the Truckee Canal for agricultural use by the Truckee-Carson Irrigation District in either or both the Truckee and Carson Divisions. The total amount of the release shall be limited to the lesser of the amount credited to the Truckee-Carson Irrigation District or the amount needed to supplement the 80,000 acre-feet of water in Lahontan Reservoir to meet the remaining seasonal agricultural requirements of the Truckee-Carson Irrigation District.

(6) From February 1, 1974, the District will be credited with an initial 50,000 acre-feet of water in Stampede. In addition to this amount, the District will be credited with the accumulated storage in excess of 5915.0 feet above mean sea level (127,600 acre-feet) in accordance with B(3) above.

(7) Insofar as possible consistent with existing decrees and with maintaining the Floristan Rates and with Operating Criteria and Procedures Sections B(1) through B(6), Stampede Reservoir (as well as the other storage facilities on the upper Truckee River) shall be operated with the objective of maintaining the following minimum rates of flow for fish, wildlife and recreation purposes in the Truckee River below Derby Dam measured at the Nixon gauge:

March 1–May 15	600 cubic feet per second
May 16–September 15	300 cubic feet per second
September 16–February 28	150 cubic feet per second

(8) At the conclusion of the water year, October 31, 1973, the District shall retain as minimum carry-over credit in

Stampede Reservoir for the 1974 water year the quantity of Truckee River water that it would have been able to divert to Lahontan Reservoir in the absence of its storage credit at Stampede. In addition, the Secretary of the Interior, in consultation with the Pyramid Lake Paiute Tribe of Indians and the Bureau of Sport Fisheries and Wildlife with respect to the requirements of the Pyramid Lake fishery, will determine: (1) the portion of the remaining storage in Stampede Lake allocated for releases to Pyramid Lake, and (2) the portion of the remaining storage in Stampede Reservoir to be allocated to the District as additional carry-over storage credit for the 1974 water year.

(9) Nothing in sections B(1) through B(8) of these Operating Criteria and Procedures shall in any way infringe on or interfere with the flood control function of Stampede Reservoir.

SECTION C

As a means of insuring that the amount of water diverted is limited to that prescribed for beneficial agricultural use, the Truckee-Carson Irrigation District shall:

(1) Deliver water only to lands for which the District has in advance established to the satisfaction of the Secretary or his designee that a current valid water right exists.

(2) Establish a single water operations center which will coordinate all orders for delivery of water to individual turnouts and which then will dispatch flows in the distribution systems so as to meet the water orders with minimum spill from the distribution system.

(3) Permit only authorized District employees to open and close individual turnouts and operate the distribution system facilities.

(4) Establish and operate sufficient stations for the measurement of all surface waters flowing out of the Truckee, North Carson, and South Carson Divisions.

(5) Initiate immediately a program for improving the measurement of the amounts of water delivered to individual turnouts. The program shall include the installation of measuring devices on at least 10 percent of the total turnouts in 1973; the program shall concentrate first on the combinations of large users and currently poor measurements; and the installed devices must be approved by the U. S. Geological Survey and the Bureau of Reclamation.

(6) Submit to the Project Office of the Bureau of Reclamation a monthly report by the 15th of the following month for each of the three divisions showing the total water delivery in acre-feet and the maximum, minimum and mean daily outflow in cubic feet per second. Reports showing the amount of water in acre-feet delivered to each farm each month during the water year shall be made at least twice during the calendar year. These reports shall be circulated to the Tribe and the members of the Truckee-Carson Operating Criteria and Procedures Committee.

(7) By June 30, 1973, establish a system, to become effective November 1, 1973, for charging water users for the quantity of water delivered to their turnouts. The system shall be designed: (a) to provide a reasonable financial incentive for economical and efficient use of water; and (b) to produce revenue against the District's operation and maintenance expenses and to assist the discharge of its debt to the United States.

SECTION D

(1) Article 32 of the December 18, 1926, contract between the United States and the District will be invoked by the Secretary for substantial violations of these Operating Criteria and Procedures and the Secretary reserves all other rights and options to enforce these criteria.

(2) If the Secretary determines that waste has occurred through negligence or inattention, after written notice the amount of such waste shall be deducted from the District's allowable maximum total diversion.

(3) The District shall not deliver water to users who do not comply with all of the terms and provisions of these Operating Criteria and Procedures. Such deliveries shall not resume without the prior approval of the Secretary or his designee.

(4) The Secretary shall not approve any applications for transfers of water rights within the Newlands Project pursuant to 43 U.S.C. § 439 unless he finds that the District is in compliance with all of the terms and provisions of these Operating Criteria and Procedures and that the applicants for such transfers are in compliance with these Operating Criteria and Procedures and with the applicable decrees. Transfers of water rights shall be restricted to the extent that there shall be no enlarged consumptive use of water within the lands of the Newlands Project.

(5) All of the water delivery operations of the Truckee-Carson Irrigation District shall be monitored closely by the Bureau of Reclamation. Any and all violations of the terms and provisions of these Operating Criteria and Procedures shall be reported immediately by the District to the Project Office of the Bureau of Reclamation.

Additional Comments. The operating criteria and procedures adopted by Judge Gesell in the Morton case were published as Interior Department regulations on March 12, 1973 (38 Fed. Reg. 6697 - 6700). TCID refused to comply with the regulations, and on Sept. 14, 1973, the Secretary notified the District that it had thereby breached its contract for operation of the Newlands Project and the contract would be terminated on Oct. 31, 1974. TCID filed a suit against the Secretary asking for a declaration that the Secretary's imposition of the operating criteria was, "improper and contrary to law," and that the notice of contract termination was invalid. (TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe of Indians; see discussion page 54 infra). Originally, TCID also asked for a preliminary injunction to prevent the termination of the contract before the suit was decided. Since the Secretary later agreed to delay takeover of the Project until "permitted to do so" by a court order, an injunction is no longer being requested. However, the Secretary has continued to promulgate the criteria periodically with modifications. (See 40 Fed. Reg. 1109 (Jan. 6, 1979); 43 Fed. 40551-40554 (Sept. 12, 1978); and 44 Fed. Reg. 37561-37563 (June 27, 1979).)

FULL NAME	Pyramid Lake Paiute Tribe of the Pyramid Lake Reservation v. United States.
SHORT OR COMMON NAME	"Indian Claims Commission Decision"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	36 Ind. Cl. Comm. 256 (July 23, 1975) Docket No. 87-B Indian Claims Commission, Washington, D.C.
PARTIES	Plaintiff: Pyramid Lake Paiute Tribe Defendant: United States
PROCEDURAL HISTORY	Filed: (see case summary for filing history.) Decided: July 23, 1975.

CASE SUMMARY

A few years before this decision, the Pyramid Lake Paiute Tribe and several other plaintiffs (4 Indian tribes and one Indian "colony") filed various claims with the Indian Claims Commission against the federal government. On April 25, 1973 the Commission issued an interlocutory (intermediate) decision in that case. (Northern Paiute Nation, et. al. v. U.S., Docket No. 87-A, 30 Ind. Cl. Comm. 210.) The decision held that when the Pyramid Lake Reservation was created, the U.S. implicitly reserved "sufficient water from the Truckee River for the maintenance and preservation of Pyramid Lake, for the maintenance of the lower reaches of the Truckee River as a natural spawning ground for fish, and for the other needs of the inhabitants of the reservation such as irrigation and domestic use." The Commission did not determine the exact amount of water reserved, nor did it determine the type or precise amount of damage that the Tribe had suffered. However, the Commissioners did decide that the government had an obligation to preserve the Tribe's waters and fisheries and that the Tribe "did not receive as much water as could have been beneficially used." The opinion left remaining for decision after trial the questions of whether the government did "whatever it was required to do, in the circumstances, to preserve the Pyramid Lake water and fisheries, and, if not, the extent, if any, of the resultant damages.".

On July 2, 1975, the Pyramid Lake Paiute Tribe filed a motion with the Commission requesting that its water claim be separated from all the other claims originally filed together and be assigned to a separate docket. After the motion was filed, but before it was decided, the Tribe and the government reached agreement on a compromise settlement of this water claim. The Commission held a hearing on the proposed settlement on July 14, 1975, and on July 23, 1975 the Commission issued decisions on both the motion and the settlement.

The Commission granted the motion separating the Pyramid Lake Paiutes' claim from the others and assigned it Docket No. 87-B. (36 Ind. Cl. Comm. 254.) Then the Commission issued findings of fact approving the settlement and awarded a final judgement of $8,000,000.00 to the Tribe against the government, as provided for in the settlement.

The findings of fact consisted mainly of determining that the settlement was fair to the parties and freely entered into by the Tribe by examining the exchange of correspondence between the parties and the steps used to obtain the approval of the Tribe's members. In addition, the Commission included in its findings the stipulation entered into by the parties on March 26, 1975. This stipulation is reproduced below.

STIPULATION FOR ENTRY OF FINAL JUDGMENT

It is hereby stipulated, agreed and understood by and between the parties, through their attorneys, as follows:

1. One of the claims presented in this case on behalf of the Pyramid Lake Paiute Tribe is for damages suffered as the result of its not having received, since 1859 to the present time, all of the water to which it was entitled under rights reserved for it at the time of establishment in 1859 of the Pyramid Lake Indian Reservation.

2. On behalf of the Pyramid Lake Paiute Tribe, the United States, among other things, is now prosecuting a suit in the United States District Court for the District of Nevada, against the Truckee-Carson Irrigation District and others, to vindicate and confirm such rights.

3. Both the Pyramid Lake Paiute Tribe and the United States are convinced that, as of the date of the establishment of the Pyramid Lake Indian Reservation in 1859, there was reserved for the benefit of the Pyramid Lake Paiute Tribe the rights to sufficient water from the Truckee River for the maintenance of Pyramid Lake, for the maintenance of the lower reaches of the Truckee River as a natural spawning ground for fish, and for other needs of the reservation, such as irrigation and domestic use. Both are convinced that such rights have not been diminished or lost by anything that has happened or been done from the time of establishment of the reservation to the present.

4. The Pyramid Lake Paiute Tribe sued here solely for damages suffered by reason of not having received all of the water to which it was entitled under such rights, which it contends were reserved for its benefit in 1859, and are reserved for its benefit today. Specifically, the Pyramid Lake Paiute Tribe did not sue here for damages or compensation for the loss, diminution or taking of any such reserved

water rights, but only for damages sustained by reason of not having received all of the water to which it was and is entitled under such rights, and no part of the award of damages to be entered pursuant to this stipulation represents damages or compensation for the loss, diminution or taking of any water rights.

5. The claim in this case, Docket No. 87-A, prosecuted on behalf of the Pyramid Lake Paiute Tribe for damages suffered by reason of its not having received all of the water to which it was entitled under such rights, which claim was the subject of the decision of the Commission entered on April 25, 1973 (30 Ind. Cl. Comm. 210), and which had been scheduled for trial before the Commission on January 27, 1975, shall be separated from all other claims in this case and shall be assigned to a new case, to be designated Docket No. 87-B.

6. Simultaneously, the plaintiffs, Northern Paiute Nation, et al., shall file with the Commission an amended petition in Docket No. 87-A, which shall expressly set forth all claims remaining in this docket. Any claim not expressly set forth in the amended petition shall be forever barred by this settlement. Such amended petition shall be accepted by the Indian Claims Commission as setting forth all remaining claims in Docket No. 87-A, which claims shall expressly exclude any claims for damages or compensation based upon acts of[sic] omissions of the United States prior to the date of execution of such stipulation that allegedly resulted in the loss of fish or fisheries, water or water rights reserved to the Pyramid Lake Indian Reservation.

7. All claims which were or could have been set forth in Docket No. 87-A, except as specifically reserved in the amended petition referred to in paragraph 6, above, shall be compromised and settled by the entry of final judgment by the Indian Claims Commission in Docket No. 87-B in the amount of $8,000,000 in favor of the Pyramid Lake Paiute Tribe. No review shall be sought of or appeal taken from such final judgment, and the United States shall waive any and all claims or demands for offsets or gratuities against the Pyramid Lake Paiute Tribe to date of execution of this stipulation.

8. The Pyramid Lake Paiute Tribe shall accept such award of $8,000,000 in full satisfaction and settlement of all damages sustained by it to date of execution hereof by reason of its having been deprived of water to which it was entitled under rights reserved for the Pyramid Lake Indian Reservation.

9. Although, as stated, both the Pyramid Lake Paiute Tribe and the United States are of the view that no water rights reserved for the Pyramid Lake Indian Reservation have been lost, diminished or taken by reason of anything that has happened or been done between 1859 and the present, and although the award of $8,000,000 to be entered pursuant to this stipulation is strictly for damages sustained by the tribe by reason of its not having received all of the water to which it was entitled under such rights, the tribe covenants, should it be finally judicially determined that, by reason of acts or omissions of the United States done or occurring prior to the date of execution hereof, water rights once reserved for the Pyramid Lake Indian Reservation were lost, taken, subordinated to other rights, or otherwise diminished, that it will not again sue the United States to recover additional damages or sue for compensation for the loss, taking, subordination or diminution of such water rights. This covenant shall not extend to acts or omissions of the United States done or occurring after the execution of this stipulation that result in depriving the reservation of water to which it is entitled under such rights as it then shall have, or that result in losses, takings, subordinations or diminutions of such rights.

Additional Comments. Since this decision was made by the Indian Claims Commission rather than a regular federal court, the determinations of water rights or other claims are not necessarily binding upon any federal court.

FULL NAME

Pyramid Lake Paiute Tribe of Indians v. Sierra Pacific Power Company.

SHORT OR COMMON NAME

"FERC Decision"

CITATION AND/OR DOCKET NUMBER; COURT; JUDGE

Federal Energy Regulatory Commission Opinion No. 61 (Aug. 10, 1979).
Docket No. E-9530.
Federal Energy Regulatory Commission, Washington, D.C..
(Initial Decision by Administrative Law Judge Nahum Litt, Nov. 25, 1977.)

PARTIES

Plaintiff: Pyramid Lake Paiute Tribe
Defendant: Sierra Pacific Power Company
Intervenors: Secretary of the Interior and State of Nevada

PROCEDURAL HISTORY

Filed: July 1, 1975.
Initial Decision: Nov. 25, 1977 (hearing May 31, 1977: Reno. Nevada).
Final Decision: Aug. 10, 1979.

CASE SUMMARY

On July 1, 1975, the Pyramid Lake Paiute Tribe filed a complaint with the Federal Power Commission, whose functions were transferred to the Federal Energy Regulatory Commission on Oct. 1, 1977. The complaint maintained essentially that the Truckee River is a "navigable water" pursuant to Section 3 (8) of the Federal Power Act (16 U.S.C. §§ 791 et seq.) and that therefore Sierra Pacific's operation of four power plants on the river without licenses from the Commission was a violation of that Act.

On Oct. 14, 1975, Sierra Pacific (SPPCo) filed an answer and a motion to dismiss, contending that the Truckee River is not navigable and no federal licenses are required for power plants on the river. On Nov. 19, 1975, the Commission allowed the Secretary of the Interior to intervene on behalf of the Tribe and the State of Nevada to intervene on behalf of its citizens. Both maintained that the river is navigable, but the State of Nevada contended that the Commission should not exercise its jurisdiction, and should defer instead to the Department of Interior's Bureau of Reclamation.

A hearing was held in Reno, Nevada on May 31, 1977, by administrative law judge Nahum Litt. The hearing was limited to the question of whether the Commission has licensing jurisdiction over the four plants. (The parties had also asked for a determination of whether Sierra could continue operation while applying for licenses, if required.) On Nov. 25, 1977, the administrative law judge issued a decision dismissing the complaint and finding that the plants were not subject to the Commission's jurisdiction under any theory, including navigability. The Commission reversed that decision on Aug. 10, 1979, holding that the Truckee is navigable and licenses are required, but allowing SPPCo to continue operation while applying. The Commission ordered SPPCo to submit license applications within six months.

Issues and Legal Theories. The basic issue in this case was whether the Truckee River is subject to the jurisdiction of the Federal Energy Regulatory Commission according to the provisions of the Federal Power Act (16 U.S.C. §§ 791 et.seq.). The Tribe(and the intervenors) asserted several grounds for jurisdiction: 1) that the Truckee is a navigable water, as defined by Section 3 (8) of the Act, 2) that the plants use "surplus water from government dams," as in Section 4 (e) of Act, 3) that primary power lines from the plants are located on public lands, and 4) that Section 4 (g) of the Act, which concerns the impact of hydroelectric plants on interstate commerce, provides an independent grounds for jurisdiction, whether or not the Truckee is navigable. The Tribe requested that SPPCo be ordered to cease operation until obtaining a license. In addition, it suggested that without the power plants' operations and without maintenance of the Floriston Rates, the flow in the Truckee would be much more favorable to the Pyramid Lake fishery.

SPPCo countered each of the theories of jurisdiction. In addition, it maintained that its operations should be allowed to continue pending any required license application. SPPCo also contended that the flow of water in the Truckee and its diversion rights are established by court decrees (the 1915 Lake Tahoe Decree and the 1944 Orr Ditch Decree), and the flow cannot be changed without modifying those decrees.

The administrative law judge rejected all the theories of jurisdiction advanced. In particular, the judge concluded that: 1) the stretch of the river where the plants are located is not navigable, 2) even though the plants utilize water released from government reservoirs, this is not "surplus" water from government dams, and SPPCo has a prior vested right to that water due to the 1915 decree, 3) that Section 4 (g) of the Act is simply an enforcement provision, which does not give independent grounds for jurisdiction, and 4) that no public lands are involved. However, the judge rejected the State's claim that FERC should defer to the Bureau of Reclamation if FERC jurisdiction were found. On the basis of his reasoning, the judge dismissed the complaint.

In reversing the initial decision, the Commission found the Truckee to be navigable from Lake Tahoe downstream to river mile 52, about 2 miles east of Reno. The Commission did not consider any of the other theories of jurisdiction. Noting that the test for navigability is whether a river is 1) presently used or suitable for use in interstate transportation of people or property, 2) was used or suitable for such use in the past, or 3) could be made suitable for such use in the future by reasonable improvements, the Commission found navigability based upon 1) regular log flotation in the late

19th-early 20th century logging operations, 2) some past and present boating, and 3) substantial federal improvements (dams, channel improvements, etc.). The Commission noted that even though a stretch of the river around river mile 27 may not be navigable in fact, it is navigable in law as an interruption in an otherwise navigable stream.

In requiring licensing for SPPCo's plants, the Commission directed the company to submit one license application covering all four plants, (Washoe, Verdi, Fleish and Farad) as well as the Independence Lake reservoir. In addition, SPPCo was directed to "show cause" why the Donner Lake development should not also be included in the same license. (Since Donner Lake is jointly owned with TCID, who was not represented in this case, the Commission did not mandate its inclusion at this time.) The Commission's reasoning was that all of the Truckee System is operated as a unit; however, since the other reservoirs (including Boca, Stampede, Prosser and Lake Tahoe) are within the jurisdiction of the Department of Interior, SPPCo cannot be required to include them in the license. SPPCo was ordered to file its showing of cause within 30 days, and its license application within 6 months. However, SPPCo is appealing the decision.

Results and Consequences. The interested parties intend to participate in any FERC licensing procedure to attempt to influence the conditions on which licenses are granted. For example, SPPCo will probably request a license for operating the plants essentially as they are operated now. The company especially wants to see the Floriston Rates maintained. However, the Tribe would like to see conditions placed upon the plants' operations which would be more favorable to the Pyramid Lake-Truckee River fishery. This might include such things as reducing flows through the plants during the winter so that more water could be stored for release during the summer months or building fish ladders at the dams.

FULL NAME	*United States v. Alpine Land and Reservoir Company, et al.*
SHORT OR COMMON NAME	"Alpine Decree"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	Civil No. D-183-BRT. Reno Federal District Court. Judge Bruce R. Thompson.
PARTIES	Plaintiff: United States Defendants: Alpine Land and Reservoir Co. (essentially replaced by TCID) and over 1000 individual water users on the Carson River in California and Nevada, including the States of California and Nevada, Sierra Pacific Power Company, and Alpine County. Intervention as defendant, counter-claimant, and cross-claimant *denied* to Pyramid Lake Paiute Tribe of Indians (431 F.2d 763 (1970)).
PROCEDURAL HISTORY	Filed May 11, 1925. Temporary Restraining Order ("Alpine Decree") issued June 9, 1949, and reissued March 21, 1950. Reopened and tried, June 4 through June 14, 1979.
CASE SUMMARY	The United States Government initiated the *Alpine* case in 1925, to quiet title to Carson River water for diversion and storage in Lahontan Reservoir as part of the Newlands Project. In 1949, a TRO was issued governing the use and allocation of Carson River water; in 1950, the TRO was reissued without significant modification to remain in effect until altered or replaced by a final decree. The TRO allowed use of Carson River water for irrigation, power generation, reclamation, storage, stock watering, municipal uses, and domestic uses. The water duty for irrigation is 2.92 acre feet per acre. Since the water supply in the river is often not enough to meet all needs, the TRO provided for "rotation" of water use on a weekly basis between California and Nevada. The TRO also contained general provisions for water use similar to those found in the Orr Ditch Decree. These include a provision that the quantity of water decreed to be applied to the land is the controlling amount for water right purposes, that waste is prohibited and reasonable, economical, beneficial use is required, and that water users may change the place, means, manner, or purpose of their use.

Since the initial construction of the Newlands Project's Truckee Canal, the Carson and Truckee Rivers have been interconnected, and thus Carson River allocation affects Truckee River rights holders and users, and vice versa. In 1928, some of the *Alpine* defendants moved to implead 252 Truckee River water users; their motion was denied. In 1968, the Pyramid Lake Paiute Tribe moved to intervene to represent and protect its interests in the Truckee River vis-a-vis the Carson River; their motion also was denied (431 F.2d 763 (1970)). The basis for denial was that the motion was not timely filed (coming 43 years after the complaint was filed and 27 years after the original trial was completed) and that the Tribe did not have the requisite interest in the subject matter of the action (Carson River water) to entitle it to intervene.

A new trial was held in the *Alpine* case on June 4-June 14, 1979, before Judge Bruce Thompson in Reno Federal District Court. A decision at that level is not expected for at least several months, and a final decision in the case will be forthcoming only after any appeals are completed.

Issues and Legal Theories. Complete information on this case was unavailable at the time of this writing. However, the major issues concern the amount of water duty which will be decreed for lands covered by the Alpine Decree (those Newlands Project lands irrigated with water from the Carson River). The United States is asking for a duty of 2.92 acre feet per acre; TCID is asking for a higher duty, such as the 4.5 allowed by the Orr Ditch Decree. In addition, there are issues of coordinating the requirements of this decree with that of other applicable decrees and regulations. There is also an issue concerning the United States' entitlement to reserved water rights for certain properties contained in the area subject to the Alpine Decree.

Case Briefs: Pending Actions

FULL NAME

United States and Pyramid Lake Paiute Tribe of Indians v. Truckee-Carson Irrigation District, et al.

SHORT OR COMMON NAME

"*U.S. v. TCID*"

CITATION AND/OR DOCKET NUMBER; COURT; JUDGE

Nos. 78-1115 and 78-1493.
9th Circuit Court of Appeals.
Lower Court: Civil No. R-2987-JBA (Reno Federal District Court, Judge J. Blaine Anderson)

PARTIES

Plaintiff: United States.
Plaintiff-Intervenor: Tribe.
Defendants: TCID as representative of Newlands Reclamation Project water users; the State of Nevada; and over 17,000 individual Nevada water users and rights holders on Lake Tahoe and the Truckee River and its tributaries (including the cities of Reno and Sparks, Washoe County, and the Sierra Pacific Power Company).

PROCEDURAL HISTORY

Filed: Dec. 21, 1973, in Reno Federal District Court.
Decided: Dec. 8, 1977.
Appealed: by the Tribe on Dec. 22, 1977, and by the U.S. on January 20, 1978.
Currently awaiting decision in the 9th Circuit Court of Appeals; expected to come up sometime within the next 2 years.

CASE SUMMARY

The United States initiated this litigation in response to the outcome of *U.S. v. Nevada and California*. In that case, the U.S. Supreme Court had refused to exercise its original jurisdiction to determine whether there is a reserved right (*Winters* doctrine right) held by the federal government in behalf of the Pyramid Lake Paiute Tribe to sufficient water to maintain the level of Pyramid Lake and thus preserve its fishery. The Supreme Court noted that Nevada federal court was a more appropriate forum for the case, so the U.S. brought this action in federal district court in Reno. The Tribe intervened as a plaintiff.

Among other things, the defendants raised the defense of *res judicata*,[*] insisting that the assertion of a fishery water right is barred at this time by the 1944 *Orr Ditch Decree*. The district court judge bifurcated the issues, with the initial trial to consider only the defenses. In December of 1977 the court decided the case, finding that *res judicata* applied to bar the government's fishery water right claim, and dismissed the Tribe's and government's complaints on that issue. Both plaintiffs appealed to the 9th Circuit Court of Appeals.

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[*] The legal doctrine of *res judicata* provides that a particular cause of action which has already been litigated between certain parties cannot be relitigated between those same parties; the first action is binding.

Issues and Legal Theories: The major issue in this case is whether the final decree entered in 1944 in *U.S. v. Orr Ditch Water Co., et al*. ("*Orr Ditch Decree*") bars the assertion of a reserved water right for fishery purposes by the Pyramid Lake Paiute Tribe and the government on behalf of the Tribe.

The government and the Tribe allege that when the Pyramid Lake Indian Reservation was established in 1859, enough water was impliedly reserved to preserve the fishery in the lake and the lower Truckee River. The legal theory behind this claim is the "*Winters* Doctrine." (*Winters v. U.S*., 207 U.S. 564). The "*Winters* Doctrine" provides that when the government established federal reservations, it reserved sufficient water "to fulfill the purpose of the reservations." In this instance, the government and the Tribe argue that the main purpose of the Pyramid Lake Reservation was to preserve the fishery for the use and benefit of the Indians, thus sufficient water was reserved to fulfill that end.

Furthermore, the Tribe and the government contend that this right has not been extinguished or barred by the Orr Ditch Decree, which decreed various water rights on the Truckee River, including some irrigation rights belonging to the government and the Tribe. The government's arguments are threefold: 1) that the fishery water right was not involved in the *Orr Ditch* case, and thus the two causes of action are different, so *res judicata* cannot be applied to bar the assertion of the claim now; 2) that the government would have had an impermissible conflict of interest in the *Orr Ditch* litigation if it had asserted the Indians' fishery claim along with the irrigation claims for the Newlands Project, so due process prevents the result in that case from barring the Tribe's present claim (a secondary argument on this point is that the Secretary of the Interior did not have and did not attempt to exercise authority under the Reclamation Act to "take" the Indians' fishery water rights for the Newlands Project); and 3) that because certain policy and technical requirements of *res judicata* are not met, the doctrine should not be applied in this case.

The Tribe's arguments against letting the *Orr Ditch Decree* bar the present claim are similar. The Tribe contends first that applying *res judicata* in this case would violate the federal government's "policy and constitutional duty to deal fairly with the Indians." In addition, the Tribe argues that the reclamation laws did not authorize the Secretary of the Interior to extinguish Indian water rights for the benefit of reclamation projects, and the Secretary did not attempt to exercise any such authority. Further, according to the Tribe, the government had an impermissible conflict of interest in the *Orr Ditch* case, thus giving the decree *res judicata* effect would violate due process. Finally, the Tribe maintains that for technical, statutory, policy, and equity reasons, the *Orr Ditch Decree* cannot and should not completely bar the present claim.

TCID in opposition contends that the Tribe's fishery right was specifically adjudicated in the *Orr Ditch* case, and the Indians' interest was adequately represented by the government, so *res judicata* operates to bar the current action. TCID also argues that there was no inherent conflict in the government's role in the *Orr Ditch* litigation which would prevent the application of *res judicata*, and that the Secretary of the Interior possessed authority under the reclamation laws to resolve any such conflict by taking the Indians' water rights for the reclamation project, which was done in the *Orr Ditch* case. The defendants also argue that statutory, technical, and policy factors support the application of *res judicata*. Finally, TCID contends that since the Tribe has recently intervened in the *Orr Ditch* case (see page 64 *infra*), and since both the Tribe and the government have accepted the benefits of the *Orr Ditch* Decree (their decreed irrigation water rights), they cannot contest the Decree's validity, and their arguments for not being bound by it and of due process violation are moot.

Possible Outcomes: The immediate result of this litigation (if the 9th Circuit's decision is not appealed to the Supreme Court, which it probably will be) will be either a determination that the District Court was correct in dismissing the Tribe's and Government's claims--in which case the trial in the District Court will proceed only on the remainder of the Government's complaint--or a decision reinstating the original complaints and remanding the case for a full trial on the merits. In the latter instance, it would probably be several years before a final determination is reached on whether the Pyramid Lake Reservation holds a *Winters* right for fishery maintenance purposes and how much water is guaranteed by that right.

However, some information on the eventual consequences of a trial on the merits can be obtained from the briefs filed with the 9th Circuit. If the Government and Tribe were to lose, the Reservation would be limited to the water right decreed in the *Orr Ditch* case, a maximum diversion of 14,742 acre feet of Truckee River water for bottomland irrigation and 15,345 acre feet for benchland irrigation. Whether or not any or all of this water could be used for fishery maintenance purposes would depend on the decision on the Tribe's petition for change in use filed under the *Orr Ditch Decree* (see page 64 *infra*).

If the Government and Tribe were eventually to win a trial on the merits, a court might declare that the Reservation has a reserved water right with an 1859 priority date to enough water to preserve the fisheries (Lahontan cutthroat trout and Cui-ui sucker) in the Lower Truckee River and Pyramid Lake. The right would probably be for enough water to maintain the lake at its present level, estimated by the Tribe at about 385,000 acre feet of average annual inflow. Of course, a court could determine that some other amount was more appropriate, and quantify the Reservation's right at any level supported by the evidence at trial.

FULL NAME

Truckee-Carson Irrigation District v. Secretary of the Interior and Pyramid Lake Paiute Tribe of Indians

SHORT OR COMMON NAME

"TCID v. Secretary"

CITATION AND/OR DOCKET NUMBER; COURT; JUDGE

Civil No. R-74-34-BRT.
Reno Federal District Court.
Judge Bruce R. Thompson (transferred from Judge Harry E. Claiborne, Oct. 31, 1978).

PARTIES

Plaintiff: TCID.
Defendant: Secretary of the Interior.
Defendant-Intervenor: Pyramid Lake Paiute Tribe.

PROCEDURAL HISTORY

Filed: March 18, 1974.
Government's motion for summary judgment denied: June 9, 1976.
Trial on merits held in October, 1979, before Judge Thompson.

CASE SUMMARY

In March of 1973, the Secretary of the Interior published in the Federal Register the regulations for Newlands Project operation ordered by Judge Gesell in the Pyramid Lake Paiute Tribe of Indians v. Morton case (see discussion at page 36 supra). TCID refused to comply with the regulations, and on September 14, 1973, the Secretary sent the District a letter cancelling (as of Oct. 31, 1974) the 1926 Contract with the Department of Interior under which TCID operates the Newlands Project. TCID responded with a letter on November 5, 1973, saying that the notice of contract termination was arbitrary, unreasonable, contrary to law, and void. TCID filed this suit in March of 1974 to prevent contract cancellation and Interior Department takeover of the Newlands Project. Although regulations similar to the 1973 criteria have been republished periodically, the Secretary has delayed actual project takeover until he receives a court order allowing him to do so.

The Secretary moved for summary judgment, alleging that there were no genuine issues of material fact in the case and that the government was entitled to judgment as a matter of law. According to the government, the basis for this claim was that the 1926 Contract and federal reclamation law gives the government authority to promulgate regulations for project operation, that since TCID was violating the regulations the District had breached the Contract, that the government had authority to terminate the Contract in case of breach, and a valid termination was exercised. In addition, the government maintained the suit was barred by sovereign immunity. However, Judge Thompson denied the government's motion. It appears that his reason for doing so was to preserve TCID as an entity before the court for further consideration of the question of whether the government had authority to promulgate these regulations and for attempting to resolve a number of issues and disputes not fully settled by the *Morton* case. The trial on the merits took place in October of 1979.

Issues and Legal Theories. The approved Pretrial Order submitted in this case lists many contested issues. Briefly summarized, they amount to disputes over 1) whether the court has jurisdiction in the case, 2) whether TCID exhausted its administrative remedies before filing suit, 3) whether the regulations are authorized, valid, and enforceable against TCID, 4) whether the Secretary's notice to TCID was adequate and proper, and 5) whether the Secretary's action violated the National Environmental Policy Act.

The dispute over jurisdiction concerns the issue of sovereign immunity. The defendants contend that the suit is really one against the United States requesting specific performance under the 1926 contract, rather than an action against the Secretary for acting outside his authority, and the former is barred by the government's sovereign immunity. The defendants' theory is that the Secretary has unquestionable statutory authority to determine whether the contract was breached, and TCID's only remedy is in the Court of Claims. TCID contends, among other things, that the Secretary did not act within his statutory authority in promulgating these regulations and thus is not immune to suit.

TCID also contends that the regulations are adjudicary in nature, and were implemented before TCID knew of them, which deprived the District of any opportunities for hearings and of any administrative remedies. The defendants maintain that TCID was fully aware of the regulations and should have challenged them administratively.

The District alleges that the Secretary's Sept. 14 letter was not adequate or proper notice for terminating the contract. TCID's theory appears to be that the notice could not be valid because TCID had not breached the contract. TCID also contends that the Secretary's regulations had to be preceded by compliance with NEPA. The defendants claim that NEPA does not apply, apparently for the reason that the regulations were ordered by a court rather than promulgated in the usual manner.

Finally, TCID's major arguments focus on the criteria themselves. The District contends that imposing any regulations violates due process since they resulted from a "sham" suit where TCID was not represented. The District's argument is that the *Morton* case was not a true adversary proceeding and the interests of all relevant parties, especially TCID, were not considered. Furthermore, TCID argues that the criteria violate provisions of the 1926 contract, that they are in conflict with vested rights of the District, that they require District action which conflicts with reclamation law, that the District's non-compliance did not breach the contract, and that for all these reasons, the regulations and the Secretary's actions exceed the Secretary's authority.

In support of these claims, TCID argues that Judge Gesell explicitly stated that his order did not "constitute an interpretation or modification of either the Alpine or Orr Ditch decrees" or anyone's rights under those decrees, and thus the diversion limitation in the regulations cannot override the greater diversions allowed by those decrees. In other words, TCID contends that the Secretary is not acting within reclamation law since the regulations operate to deprive the District of decreed water rights, especially since the District was not involved in the Morton case.

Another major aspect of TCID's argument is that the Secretary claims to have terminated the contract for breach due to violations of certain of the regulations, not including the diversion limitation, when it was really the diversion limitation he was concerned about. The District claims that it was impossible and unlawful for the Secretary to enforce the limitation and thus improper to cancel the contract on that basis. Finally, TCID contends that the regulations violate contract provisions governing District use of Lahontan Reservoir and supply of water to irrigated lands.

The defendants essentially counterall these attacks on the regulations, contending that the Secretary was well within his authority in promulgating the regulations and cancelling TCID's contract. An additional issue which may be considered in the case is the impact of the Endangered Species Act on the court's review of the regulations.

Possible Outcomes. If the government is successful on the sovereign immunity issue in this case, TCID's complaint would be dismissed and the Secretary's termination of the contract would take effect. If the court agrees with TCID on the sovereign immunity question, a trial on the merits will proceed. The issues are numerous and complex, but basically the consequences will be either the invalidation of the operating criteria and the continuance of the 1926 contract allowing TCID's operation of the Newlands Project or the enforcement of the regulations and termination of the contract if TCID continues noncompliance.

The most important result is the amount of TCID diversion which will be allowed by either outcome. If TCID wins its lawsuit, it will probably continue to divert up to 406,000 acre feet of water from the Truckee River at Derby Dam. If the defendants win, whether or not the government actually takes over the Newlands Project, the diversion will be limited to 288,129 acre feet according to the specifications in the Morton case.

discussed at page 36 , *supra*. The case was tried before Judge Bruce Thompson in October of 1979, but the final results will not be known for some time, until any appeals are completed and a final decision is reached.

FULL NAME	City of Fallon, et al. v. Secretary of the Interior
SHORT OR COMMON NAME	"NEPA Case"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	Civil No. R-74-101-BRT. Reno Federal District Court. Judge Bruce R. Thompson.
PARTIES	Plaintiffs: City of Fallon; County of Churchill; Frank deBraga; Garland Kennedy; Bud Dory; Gene McMullin; Demar Thurman; Nevada Wildlife Federation, Inc.; George Wilkerson; Canvas Back Gun Club, Inc.; Greenhead Hunting Club, Inc.; and George Lott. Defendant: United States Secretary of the Interior.
PROCEDURAL HISTORY	Filed: July 29, 1974. Postponed indefinitely pending outcome in *TCID v. Secretary of the Interior* (see pp. 54-57 *supra*).
CASE SUMMARY	Complete information on this case was unavailable at the time of this writing. Basically, the City of Fallon, Nevada, and other interested parties sued the Secretary of the Interior, alleging violation of the National Environmental Policy Act for his promulgation of operating criteria for the Newlands Reclamation Project without first preparing an Environmental Impact Statement on the effects of the operating criteria. In particular, the plaintiffs were concerned with the impact of the criteria on the Stillwater Wildlife Management Area. The Secretary of the Interior assured the plaintiffs that it would not actually take over the operation of the Newlands Project and implement the operating criteria until permitted to do so by a court (i.e., until the resolution of the *TCID v. Secretary of the Interior* litigation). Therefore, the issue became moot and further action on this lawsuit was postponed indefinitely.

FULL NAME	Carson-Truckee Water Conservancy District et al. v. Cecil D. Andrus et al.
SHORT OR COMMON NAME	"Stampede Suit"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	Civ. No. R-76-152-HEC (formerly Civ.No.R-76-152-BRT). Reno Federal District Court. Judge Harry E. Claiborne (formerly Bruce R. Thompson).
PARTIES	Plaintiffs: Carson-Truckee Water Conservancy District, Sierra Pacific Power Company, and State of Nevada. Defendants: Secretary of the Interior Cecil D. Andrus and other governmental officials. Defendant-Intervenor: Pyramid Lake Paiute Tribe of Indians.
PROCEDURAL HISTORY	Filed: 1976. Motions for summary judgement denied: Aug. 27, 1979. Trial expected in spring or summer of 1980.

CASE SUMMARY

The Carson-Truckee Water Conservancy District (CTWCD), Sierra Pacific Power Company (SPPCo), and the State of Nevada brought this suit against the Secretary of the Interior and others to compel them to operate Stampede Reservoir to provide water to the cities of Reno and Sparks for municipal and industrial (M and I) uses. The plaintiffs mainly alleged that the Secretary's operation of Stampede primarily for maintaining instream flows to benefit the Pyramid Lake and Truckee River fisheries is in violation of reclamation law and other Congressional acts, including the Washoe Project Act (70 Stat. 775, 43 U.S.C. § 614 *et seq.*), which authorized Stampede's construction. The defendants maintained that Stampede's operation for fishery maintenance and other non-M and I purposes was within the Secretary's discretion. The Pyramid Lake Paiute Tribe intervened on the government's side.

On November 22, 1977, CTWCD and SPPCo filed a motion for partial summary judgment in the action. They requested a declaratory judgment stating that the government was obligated to supply M and I water from the reservoir, and to enter a contract with CTWCD for supplying water to its water users and accepting cost reimbursement payments for the reservoir. The support for the motion consisted mainly of an examination of statutory provisions and legislative history behind Washoe Project Act authorizations and appropriations, and others, which allegedly proved that Stampede was to be operated for M and I purposes and paid for partly by a reimbursement contract with CTWCD, and that current operation is illegal.

The defendants filed a cross-motion for summary judgment, claiming that the Endangered Species Act

(ESA)*/ modified the obligation to enter into a water supply and cost reimbursement contract and compelled the Secretary to operate Stampede for fishery purposes.

On Aug. 27, 1979, Judge Harry E. Claiborne issued a Memorandum Decision denying both motions for summary judgment and narrowing the issues in the case for trial. The decision stated essentially that the issues were (1) whether the Washoe Project Act compelled the Secretary to enter into a contract with CTWCD to distribute the water and receive cost reimbursement payments, and (2) whether the ESA changed that obligation. The court found, as a matter of law, that the Secretary *is* obliged to enter a contract with CTWCD. The court then stated that the critical issue concerning the ESA is whether there is an "irreconcilable conflict" between diverting Stampede water to Reno and Sparks and the welfare of the endangered cui-ui lakesucker and threatened Lahontan cutthroat trout.** The court noted that, at least in regard to the cutthroat, there *is* an irreconcilable conflict. The issue for trial was stated as: whether the Secretary's action in adopting a regulation (40 Fed. Reg. 29864 (1975)) which specified that the reason for the cutthroat's threatened status is diversion of water from the Truckee was supportable under the Administrative Procedure Act (5 U.S.C. § 702 *et seq*.). (Since diversions from the river are responsible for the problem, less Stampede water flowing down the river would hurt the fish - this is the conflict seen by the court.)

The plaintiffs filed a motion on Oct. 9, 1979, for clarification of the decision. They requested a reconsideration and a finding that the only issue remaining for trial is whether Stampede could be operated for M and I purposes without violating the ESA. Finally, the plaintiffs asked for a reconsideration of (1) the dismissal of one of its claims for relief and (2) the findings of fact in the Memorandum Decision. (The court had dismissed plaintiffs' claim that the Secretary's failure to enter a contract with CTWCD was a violation of the Administrative Procedure Act as "superfluous," since he had found that the Reclamation Act required the contract. Plaintiffs insist that the claim, although based on the requirements of the Reclamation

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*/ See the discussion of the ESA at page 93 *infra*.

**The "irreconcilable conflict" language comes from the ESA itself (see page 100 *infra*) and from the Supreme Court case *TVA v. Hill*, 437 U.S. 153, 98 S. Ct. 2279 (1978) interpreting the ESA. The "irreconcilable conflict" in this case would be if Stampede could not be operated as plaintiffs request without jeopardizing the continued existence of the two fish.

Act, is a separate claim and not superfluous, and should be reinstated. In addition, the plaintiffs contend that certain of the court's factual findings were based on inadmissible evidence and hence were improper.)

Possible Outcomes. The immediate outcome in this case will be a decision on the plaintiffs' latest motion and a clarification of the issues for the trial, which is expected to take place in spring or summer of 1980. Although the precise formulation of the issues cannot be predicted, the trial undoubtedly will concern in some way defendants' obligations under the Endangered Species Act in regard to Stampede Reservoir.

The eventual outcome of the case will be a determination of the allowable and required uses of water stored in Stampede Reservoir, and of the impact of the ESA on the reservoir's operation. The plaintiffs are asking essentially for a declaration that Stampede can be operated for M and I purposes without creating an "irreconcilable conflict" with the continued existence of the two fish species, and that CTWCD is entitled to 22,900 acre feet of Stampede water per year to supply M and I uses in Reno and Sparks. If the plaintiffs were completely successful, the Secretary could possibly be directed to execute a contract with CTWCD to provide them with that amount of water.

If the defendants were successful, Stampede could continue operation primarily for fishery maintenance uses, without supplying any water at all for M and I purposes. (If the plaintiffs' data on historical operations are correct, these fishery releases from Stampede have ranged from 13,280 acre feet in 1973 to 102,610 acre feet in 1976.)

It is possible that the court could determine that some amount of M and I water supply (less than 22,900 AF) is compatible with the continued existence of the fish species and with the Secretary's obligations under the ESA, and that the Secretary has an obligation to release that amount. Whatever the decision, however, it is likely that the case would be appealed, and thus a final outcome is probably a few years away.

Additional Comments. Stampede's operation would also be affected by the regulations at issue in the TCID v. Secretary of the Interior and Pyramid Lake Paiute Tribe litigation discussed at page 54 supra.

FULL NAME	*United States v. Orr Ditch Water Company, et al.*/ Petition of the Watermaster.
SHORT OR COMMON NAME	"Watermaster's *Orr Ditch* Petition"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	Equity No. A-3. Reno Federal District Court. Judge Harry E. Claiborne.
PARTIES	Same as original suit, p. 30 *supra*.
PROCEDURAL HISTORY	Filed June, 1976. Pending as of November, 1979.
CASE SUMMARY	Complete information on this petition was unavailable at the time of this writing. Briefly, the Watermaster in charge of administering the Orr Ditch Decree and managing the Truckee River (Claude Dukes) has filed a petition requesting guidance in how to carry out his mandate in conformance with several conflicting decrees and regulations.

FULL NAME	Nevada v. United States
SHORT OR COMMON NAME	None
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	No. 78-1105. 9th Circuit Court of Appeals. (Lower Court: Civil Action No. R-76-235-BRT Reno Federal District Court Judge Bruce R. Thompson)
PARTIES	Plaintiff: State of Nevada Defendant: United States
PROCEDURAL HISTORY	Unknown.
CASE SUMMARY	Complete information on this case was unavailable at the time of this writing. Briefly, the State of Nevada sued the United States government to obtain state jurisdiction over the bed of Pyramid Lake. The federal district court, by Judge Bruce R. Thompson, dismissed the State's action, and the State appealed to the 9th Circuit Court of Appeals. The appeal was pending as of October, 1979.

FULL NAME	United States v. Orr Ditch Water Company, et. al./ Petition for Change in Place and Purpose of Use.
SHORT OR COMMON NAME	"Tribe's Orr Ditch Petition"
CITATION AND/OR DOCKET NUMBER; COURT; JUDGE	Equity No. A-3. Reno Federal District Court. Judge Harry E. Claiborne.
PARTIES	Same as original suit.
PROCEDURAL HISTORY	Filed: April 2, 1979. Pending as of October, 1979.

CASE SUMMARY

The 1944 Orr Ditch Decree provided two water rights for the United States to irrigate lands on the Pyramid Lake Indian Reservation, as well as the government's decreed right for water to irrigate Newlands Project lands. The Reservation's water rights were for a maximum diversion of 14,742 acre feet per year through Indian Ditch to irrigate 3130 acres of bottom lands and a maximum diversion of 15,345 acre feet per year through any ditch to irrigate 2745 acres of benchlands. The decree did not contain any provision for a fishery water right for the Pyramid Lake Paiutes. In 1979, the United States, as trustee for the Tribe, filed this petition with the federal district court to request a change in use for those decreed agricultural water rights to allow their application to fishery maintenance purposes.

Issues and Legal Theories. The Orr Ditch Decree states that any parties whose rights were adjudicated by that decree are entitled to change "the point of diversion and the place, means, manner or purpose of use" of their water "in the manner provided by law," as long as this does not injure others' rights. Under this provision, the Paiutes are requesting that they be allowed to utilize their Orr Ditch water to operate the Marble Bluff Dam and Fishway at the mouth of the Truckee River and to maintain instream flows for fish migration and spawning. According to the petition, the fishway requires a flow of approximately 50 cfs at 56° or less. The petition states that some of this need could be met by allowing the Tribe to apply its agricultural right to maintaining instream flows.

One of the issues raised by the petition is what is the "manner provided by law" governing the Tribe's change in use. Ordinarily, changes would be determined by state law, but the petition contends that federal common law governs the Tribe's requested change. The Tribe's theory is that Indian property rights are determined by federal law and that anything concerning Indian water rights is a federal question. Since there is no applicable federal statute, federal common law must be applied.

The petition contends that the change would not harm junior users any more than if the Tribe were using all their decreed rights for irrigation, thus there is no reason to deny the change. In addition, the petition maintains that allowing the change would fulfill the mandates of the Washoe Project Act and the Endangered Species Act, as well as encourage a viable Reservation economy.

Possible Outcomes/Consequences. According to the petition, the Paiutes are currently irrigating only about 1000 acres of bottomlands on the Reservation. This leaves an unexercised water right of approximately 25,377 acre feet. If this petition is successful, the Paiutes would be entitled to have about that amount of water (minus reasonable transportation losses) reach the mouth of the Truckee River (where Marble Bluff is located) each year. Since the Reservation's rights have a very early priority date (Dec. 8, 1859), this could have substantial impact on other Truckee River water users, though no more than would have occurred if the Indians were fully exercising their decreed irrigation rights.

In addition, the petition officially requests a change in use for the full decreed right (including that currently used for irrigation), approximately 30,087 acre feet annually. The Indians, with notice to the water master, would then have discretion to determine how much water would be applied annually to irrigation and how much to fishery maintenance.

If the petition is denied, the Tribe will be able to use their Orr Ditch decreed rights only as provided in the decree (i.e., diverted at the points specified in the decree and used only for irrigation).

SUBAPPENDIX C-2

Water Rights Inventory for Potential Land Application Sites for the Reno-Sparks Sewage Effluent

January 1979

Prepared by:

Walters Engineering
Reno, Nevada

Contained in:

Institutional Constraint Evaluation of
Land Application Sites and Water Right
Availability for Reno-Sparks Sewage Effluent

by

University of Nevada, Desert Research Institute
Walters Engineering

Water Rights Inventory for Potential Land Application Sites for the Reno - Sparks Sewage Effluent

WALTERS ENGINEERING
CIVIL ENGINEERING CONSULTANTS

WATER RIGHTS INVENTORY

INTRODUCTION

From the beginning of this study, it was clearly evident that water rights would play a significant part in determining if land application of the Reno-Sparks sewage (effluent) is possible. The timetable for securing agreements, design and construction by 1983 of an approximately 60 c.f.s. pipeline system, and possible storage and irrigation works for up to 44,000 acre-feet requires an immediate "go, no-go" decision regarding further consideration of land application vs. some form of advanced wastewater treatment. Land and/or water rights may have to be secured now to meet the required timetable for design and construction. Therefore, Tables 1, 2 and 3 listing water rights on the Truckee River are introduced which were necessary for discussions with concerned entities and for assessing the potential for utilizing unused water rights in connection with land disposal.

PURPOSE OF CURRENT STUDY

The purpose of the current study was to determine:
"Potential for utilizing unused water rights, purchasing additional water rights or trading water rights will be evaluated. This evaluation will be based on Part A-1 (list of existing water rights on the Truckee River including amounts of allocated water) which will provide an indication of whether any unused water rights are available, whether any other might be purchased and the cost and whether a trade of water rights is possible and under what conditions."

EXISTING WATER RIGHTS

Tables 1 and 2 itemize by ditch decreed and current theoretically needed water. Major Municipal and Industrial (M&I), rights from ditches and directly from the River (Table 3) are also included on Tables 1 and 2. Theoretically the original decreed

Ditch Identification #	Ditch Name	Acreage Served by Each Ditch as per the Decree of 1944*	Acreage Removed from Land Irrigated by Ditch (1944-1975)**	Acreage Added to Land Irrigated by Ditch (1944-1975)**	Total Calculated Acreage of each Ditch as of 1975**	Total Acreage as Listed in the 1978 Guide-lines***	Volume of Water Decreed to Each Ditch by Decree of 1944 (AF/YR)	Volume of Water Neces-sary for Irrigation of Lands Currently under Irrigation(1978)(AF/YR) and M&I***	Theoretically Available Water Rights Per Ditch (AF/YR)****
1	Steamboat	4,125.3	577.5	500.0	4,047.8	3,903	16,468	15,870	598
2	Coldron	308.5	74.0	0	234.5	263	1,390	1,390	0
4	Katz	106.0	56.7	0	49.3	74	477	334	143
5	Washoe Power	76.6	0	0	76.6	77	307	307	0
7	Hogan	178.0	178.0	0	0	-	712	-	712
8	Mastin	24.3	0	0	24.3	-	98	-	98
9	Last Chance	2,039.9	771.4	50.0	1,318.5	1,736	8,644	6,791	1,853
10	Sparks-Capurro	56.9	54.0	0	2.9	-	228	224	4
11	Irwin-Mayberry	46.4	46.4	0	0	-	186	-	186
12	Lake	1,954.5	495.2	207.7	1,667.0	1,663	7,948	6,792	1,156
13	Southside Canal	1,326.6	1,294.6	0	32.0	66	5,555	265	5,290
14	Orr System	3,999.1	1,052.6	185.2	3,131.5	2,921	16,791	10,870	5,921
15	Indian Flat	420.2	420.2	0	0	-	1,942	-	1,942
17	Countryman	51.1	51.1	0	0	-	232	-	232
18	Chism	32.2	32.2	0	0	-	145	-	145
19	Hayden (Court)	-	-	-	0	-	-	-	-
20	English Mill	561.0	561.0	0	0	-	1,922	-	1,922
23	Sullivan & Kelly	706.7	587.7	0	119.0	44	2,830	174	2,656
24	Cochran	2,015.7	1,397.2	0	618.5	468	8,151	1,767	6,384
25	Scott Ranch	527.4	527.4	0	0	-	2,352	-	2,352
27	Abbee	430.5	430.5	0	0	-	1,842	-	1,842
28	Perry	48.0	48.0	0	0	-	216	-	216
29	Eastman	428.5	410.5	0	18.0	9	2,191	38	2,153
30	North Truckee	1,719.3	1,337.8	0	381.5	425	7,490	1,698	5,792
31	Sessions	372.4	322.4	0	50.0	67	1,654	301	1,353
33	Pioneer	2,020.5	269.8	0	1,750.7	1,521	7,678	5,462	2,216
34	Stephens	535.8	535.8	0	0	-	2,029	-	2,029
35	Glendale	914.7	479.1	0	435.6	307	3,490	1,184	2,306
	Subtotals	25,026.1	12,011.1	942.9	13,957.9	13,544	102,968	53,467	49,501
ALSO									
6	Highland	1,832.5	1,164.7	183.0	850.8	540	26,183	34,620	-8,437
	TOTALS (With Highland)	26,858.6	13,175.8	1,125.9	14,808.7	14,484	129,151	88,087	41,064

*From Truckee River Decree of 1944

**From Court Records

***From Water Master's Office

****Includes SPPCo Decreed & Purchased M&I rights

TABLE 1

TRUCKEE RIVER - APPROXIMATE SURFACE WATER USE AND RIGHTS - TRUCKEE MEADOWS

Ditch Identification	Ditch Name	Acreage Served by Each Ditch as per the Decr of 1944*	Acreage Removed from Land Irrigated by Ditch (1944-1975)**	Acreage Added to Land Irrigated by Ditch (1944-1975)**	Total Calculated Acreage of each Ditch as of 1975**	Total Acreage as List in the 1978 Guidelines ***	Volume of Water Decre to Each Ditch by Decree of 1944 (AF/YR.	Volume of Water Neces sary for Irrigation o Lands Currently und Irrigation (1978)(Af and M&I***	Theoretically Availab Water Rights per Ditc (AF/YR)****
36	Fairchild Pump	4.5	4.5	0	0	-	16	-	16
37	Largomarsino-Murphy	194.2	0	0	194.2	194	874	874	0
38	Largomarsino-Noce	31.4	18.4	0	13.0	11	142	49	93
39	Groton	33.5	0	0	33.5	34	151	151	0
40	Sheep Ranch	79.9	33.3	0	46.6	47	360	210	15C
41	McCarran (North)	182.9	0	30.6	213.5	134	823	601	360
42	McCarran (South)	30.6	30.6	0	0		138		
43	Old	102.0	102.0	0	0	-	460	-	460
44	Hill	236.9	0	0	236.9	237	1,067	1,067	0
48	Preston	42.0	0	0	42.0	42	168	168	0
49	Washburn	32.7	0	0	32.7	33	131	131	0
50	Cadlini	86.5	0	0	86.5	87	346	346	0
51	Gregory-Monte	147.8	0	22.5	170.3	148	666	666	0
52	Wadsworth Power	45.0	45.0	0	0	-	192	-	192
53	Herman-Carravanta	351.1	0	0	351.1	351	1,493	1,493	0
54	Pierson	82.8	46.2	0	36.6	61	352	261	91
55	Olinghouse #1	107.9	-	-	-	-	487	-	487
56	Proctor	243.0	-	-	-	204	1,094	912	182
57	Fellnagle	239.1	0	0	239.1	95	957	381	576
58	Olinghouse #2	32.4	-	-	-	-	130	-	130
59	Gardella	56.3	0	0	56.3	56	226	226	0
60	Olinghouse #3	80.3	-	-	-	80	322	322	0
61	Indian (bottom lands)	-	-	-	-	1,000	12,531	4,000	8,531
	Indian (bench lands)	-	-	-	-	0	11,255	0	11,255
	Totals (without Truckee Canal)	2,442.8	280.0	53.1	1,752.3	2,814	34,381	11,858	22,623

TABLE 2

TRUCKEE RIVER - APPROXIMATE SURFACE WATER USE AND RIGHTS - BELOW VISTA

TABLE 3

TRUCKEE RIVER - ESTIMATES OF MAJOR MUNICIPAL AND INDUSTRIAL (M & I) SURFACE WATER RIGHTS - 1978

(Includes ditches formerly used for M & I which are now retired)

	Ditch Identification Number	Ditch or River Diversion	Estimate of M & I Rights as of 1978 - AF/YR	Comments
Above Vista	1	Steamboat	1,192	Steamboat Ditch serves both M & I and irrigators
	3	Verdi Power		Hydro power only except for Katz Ditch
	5	Washoe Power		Hydro power only
	6	Highland - decreed 40 cfs plus purchased	32,524	Highland Ditch is combined M & I plus irrigation
	16	Reno Power		Hydro power only (retired)
	21	Idlewild Water Treatment Plant (river pumps)	14,669	M & I only
	22	Riverside Mill		Retired
	26	Reduction Works		Retired
	32	Glendale Water Treatment Plant (River pumps)	2,242	M & I only
Below Vista	45	Tracy Power Plant (river pumps)	5,375	Power plant cooling
	46	Eagle-Picher Plant		Status?
	52	Wadsworth Power	2,266	Retired

amounts, minus the sum of the 1978 theoretical water needed and 1978 M & I surface rights equals the theoretically unused water rights and total 52,432 AF. Because of retirements and transfers one must be careful in evaluating this difference in each ditch.

DISCUSSIONS WITH CONCERNED ENTITIES

Water rights discussions with representatives of the Nevada State Engineer (State Engineer), Pyramid Lake Tribal Council (Indians), Federal Watermaster (Watermaster), Sierra Pacific Power Co. (S.P.P.Co.), Truckee Carson Irrigation Ditch (TCID) and irrigators on the river below Vista (downstream irrigators) were held. Some of the important topics discussed were:

1. Agreements with the Indians which must be developed to assure that construction of either some form of advanced wastewater treatment or the pipeline to land application facilities will not decrease river flow volumes or its quality.
2. The results of the potential decrease in irrigation and power plant cooling water in the river below Vista in extreme dry years if the effluent is removed from the river.
3. The results of potential decreases in sewage and irrigation return flows at Derby Dam for the TCID if the effluent is removed from the river.
4. The possibility and extent of litigation that might result which would be expensive and time consuming and could preclude the July 1983 Master Project target date.
5. The identification and protection of fish and wildlife habitats.
6. How the State Engineer intends to consider sewage effluent since there are two extant applications submitted from Reno not acted upon as yet.
7. Availability and value of water rights for reallocation to upstream storage for river flow augmentation below Vista and, the potential for protests that such allocation has.
8. System operation, particularly full utilization of Stampede Reservoir and Lake Tahoe.

Appendix C briefly summarizes the discussions with the above representatives.

Further, Appendix D which summarizes Federal and State water rights, Judge Gezells order, and the current water rights suit is a partial result of the above discussions.

The importance of the above topics will vary depending on the scenario that might be chosen for the development of land application. It is obvious that most land application projects will create river flow depletions between the Reno-Sparks Joint Water Pollution Control Plant and Derby Dam. Therefore, some mechanism for these projects must be found to augment the flow in that area if the sewage effluent is conveyed in a pipeline which would bypass this region.

Based on the above considerations, there are several potential ways that flow augmentation potentially could be approached by the Cities of Reno and Sparks (Cities). Any of these will require careful negotiation with various affected parties on the River system. Mechanisms that might be developed through negotiations include:

I. Secure Out of Basin Water

II. Closer Management/Reallocation/Reassignment of Water

III. Purchase of Existing Land or Water Rights

IV. Use of Groundwater in Times of Extreme Drought

V. Rehabilitation and Betterment in the TCID Proposed by the U.S. Bureau of Reclamation (USBR)

These potential sources are further described as follows:

I. OUT OF BASIN WATER - Unallocated out-of-basin sources in Nevada of any magnitude are non-existant but potentially California water could, with appropriate exchange, possibly augment an ultimate land application project. However, time is not sufficient for out-of-basin acquisition of replacement water for land application to be on line by July 1983.

II. MANAGEMENT/REALLOCATION/REASSIGNMENT OF WATER - Management, reallocation, and reassignment of existing Truckee-Carson system supplies have significant potential for an ultimate Master Project for the Reno-Sparks area. Looking initially at sections of the Nevada State Water Law which might be applicable in making changes in the Truckee-Carson water system are:

> NRS 533.010 "Person" defined. As used in this chapter, "person" includes a corporation, an association, the United States, and the state, as well as a natural person.
>
> NRS 533.025 Water Belongs to public. The water of all sources of water supply within the boundaries of the state whether above or beneath the surface of the ground, belongs to the public.

NRS 533.035 Beneficial Use: Basis, measure and limit of right of use. Beneficial use shall be the basis, the measure and the limit of the right to the use of water.

NRS 533.040 Water used for beneficial purposes to remain appurtenant to place of use; exceptions. All water used in this state for beneficial purposes shall remain appurtenant to the place of use: provided

1. That if for any reason it should at any time become impracticable to use water beneficially or economically at the place to which it is appurtenant, the right may be severed from such place of use and simultaneously transferred and become appurtenant to other place or places of use, in the manner provided in this chapter, and not otherwise, without losing priority of right heretofore established; and
2. That the provision of this section shall not apply in cases of ditch or canal companies which have appropriated water for diversion and transmission to the lands of private persons at an annual charge.

NRS 533.045 Right to divert ceases when necessity for use does not exist. When the necessity for the use of water does not exist, the right to divert it ceases, and no person shall be permitted to divert or use the waters of this state except at such time as the water is required for a beneficial purpose.

NRS 533.050 Beneficial use of water declared a public use: eminent domain. The beneficial use of water is hereby declared a public use, any person may exercise the right of eminent domain to condemn all lands and other property or rights required for the construction, use and maintenance of any works for the lawful diversion, conveyance and storage of waters.

NRS 533.055 Storage of water for a beneficial purpose; claiming, diversion of water turned into natural channel, watercourse. Water may be stored for a beneficial purpose. Water turned into any natural channel or watercourse by any person entitled to the use thereof, whether stored in Nevada or in an adjoining state, may be claimed for beneficial use below, and diverted from the channel or watercourse by such person, subject to existing rights, due allowance for losses to be made, as determined by the state engineer.

NRS 533.060 Regulations as to use, appropriation of water; abandonment of rights; acquisition of prescriptive right not permitted.

1. Rights to the use of water shall be limited and restricted to so much thereof as may be necessary, when reasonably and economically used for irrigation and other beneficial purposes, irrespective of the carrying capacity of the ditch. All the balance of the water not so appropriated shall be allowed to flow in the natural stream from which such ditch draws its supply of water, and shall not be considered as having been appropriated thereby.
2. In case the owner or owners of any such ditch, canal, reservoir, or any other means of diverting any of the public water shall fail to use the water therefrom or thereby for beneficial purposes for which the right of use exists during any 5 successive years, the right to so use shall be deemed as having been abandoned, and any such owner or owners shall thereupon forfeit all water rights, easements and privileges appurtenant thereto theretofore acquired, and all the water so formerly appropriated by such owner or owners and their predecessors in interest may be again appropriated for beneficial use the same as if such ditch, canal, reservoir, or other means of diversion had never been constructed, and any qualified person may appropriate any such water for beneficial use.
3. No prescriptive right to the use of such water or any of the public water appropriated or unappropriated can be acquired by adverse user or adverse possession for any period of time whatsoever, but any such right to appropriate any such water shall be initiated by first making application to the state engineer for a permit to appropriate the same as provided in this chapter and not otherwise.

In view of the State water law, the Cities will have to work closely with the State Engineer, the Water Master, and the U.S. District Court to obtain any change in the management of the Truckee River System or reallocation or reassignment of water for use by the Cities. Initially the Cities should seek enforcement of the Orr Ditch Decree of 1944. Table 1 and 2 present a summary of the Truckee Meadows decreed acreage and water right under the Orr Ditch Decree of 1944, current acreage irrigated, and current theoretical water requirements. The tables show that between the 1944 Decree and 1975 the total acres irrigated went from 26,858.8 requiring 124,606 acre-feet of water to 14,084 acres in 1975, 13,009 acres in 1977, and the Watermasters projected 14,084 for 1978. If the Orr Ditch Decree of 1944 were followed the acre-feet of water required to irrigate the 13,009 acres would be 67,203 and for the 14,084 acres approximately 76,600. However, according to the records, the amount of water diverted from the Truckee River to the Truckee Meadows exceeded the Decreed amount by more than a factor of two during 1975-1976. Further, in 1977 which was the severest drought of record in the Truckee River Basin, the diversions from the Truckee River to the Truckee Meadows were also higher than was allowed by the Orr Ditch Decree by a factor of 1.6. In essence, even in the severest drought, the agricultural lands in the Truckee Meadows got more than their full allotment based on the best data available from the Water Master's office.

This data indicates that in normal water years, a great deal of water is diverted from the Truckee River particularly in the Truckee Meadows, that is above the amount required. However, several aspects have to be taken into consideration, such as:

a. The Water Master needs additional manpower to make sure that the proper amounts of water are diverted from the Truckee River to the Truckee Meadows.

b. How much of the excess waters that have been diverted return to the Truckee River and how much of it recharges the groundwater, evaporates or is transpired? For example, if two-thirds of the excess water diverted in the Truckee Meadows for irrigation were returned to the river and one-third consumed, this water would provide approximately 25,000 acre-feet for other beneficial uses if stored in upstream reservoirs.

c. The amount of land under irrigation in the Truckee Meadows is often questioned. As far as anyone seems to know, the actual acreage has not been measured since the 1940' s.

The Federal Water Master has asked the Federal District Court for clarification on the manner in which he operates the diversions from the Truckee River. The Cities of Reno and Sparks should encourage an early reading from the Court and make application for a right to the water that would be saved for other beneficial uses in case the Orr Ditch Decree is adhered to by the Court. The Cities of Reno and Sparks should also request that the actual agricultural acreage be measured so that realistic amounts of water can be diverted from the Truckee River. Many agricultural acres have gone out of production and covered with urban developments in recent years and there is not an accurate number for the remaining acres in production.

III. PURCHASE OF EXISTING WATER RIGHTS

a Water rights in the Truckee Meadows could be purchased, however, it is anticipated that reallocation of these rights to storage for pure flow augmentation would be protested by M & I interests in the Truckee Meadows.

b Water rights below Vista, excluding SPPCo. and Indian rights - there are approximately 4000 AF of these irrigation water rights below Vista. Several ranchers below Vista were personally contacted, and Appendix A herein summarizes their responses to the proposed Land Disposal Project. In essence, the Cities could purchase their water rights by buying their ranches. SPPCo is not interested in selling any of its downstream water rights. The Cities could acquire some of these downstream properties by purchase and/or condemnation and make application to the State Engineer to change the point of diversion and time and place of use for flow augmentation - utilizing closer management of upstream storage. This "drying up" farmlands thus theoretically reducing required irrigation flows below Vista is certain to be protested by all water users below Vista. Because of (1) the high cost and small quantity of water involved, and (2) certain delays because of protests and litigation, pursuit of other sources are advised.

c Purchase SPPCo winter river-run hydroelectric flow rights. This approach will involve the State Engineer, the Watermaster, and the SPPCo in evaluating the water used for generating hydroelectric power vs. the energy costs of operating some form of advanced wastewater treatment facilities.

The Cities could possibly purchase the capitalized value of say 100 cfs of wintertime hydroelectric flows from the power company, hold it upstream and use it for augmenting Truckee River flows below Vista. The amount of energy saved through not having to develop advanced wastewater treatment would have to be analyzed and weighed against increased farm production, and the energy production loss. This option would require a change in the Floristan rates and has interesting considerations, some of which are:

1. More efficient operation of the system - primarily Tahoe/Boca and Stampede might result in the parties on the river not "fighting" the required change in Floristan rates.
2. Closer upstream storage management along with (a) lowering the Floristan rates in the winter and raising them in the summer, and (b) allowing surface M & I water to be diverted at a rate higher than the present maximum of 25% of entitlement per month might allow SPPCo to utilize all of its decreed and purchased surface rights. In 1977, SPPCo primarily because of the above rate of diversion limitation, used 28,181 AF of the approximately 60,000 AF of its surface M & I basic and purchased rights in the Truckee Meadows. The total M & I sendout of water to the system in 1977 was 40,673 AF, the difference, or 12,492 AF, being made up with groundwater.
3. From system records it appears that this year, water could have been held upstream and more surface M & I water used - resulting in conservation of groundwater.

To buy land with good basic water rights to possibly yield at least enough water for partial land application development is possible. However, depending on the alternative chosen, consideration will have to be given to the viability of existing reclamation projects as indicated in the response from the U.S. Bureau of Reclamation mentioned earlier in this report. Also, if water rights are purchased, the most effective usable water rights are those that can be obtained from the lower end of the system where reallocatable rights do exist. Whereas options I & II, and the groundwater option IV which follows, are intended to satisfy only below Vista flow depletions, the purchase option does have the possibility of concurrently obtaining water and a site for land disposal. All of the above water rights purchase options for land disposal will require closer management of the water in the Truckee River system.

IV. USE OF GROUNDWATER IN TIMES OF EXTREME DROUGHT

The Truckee Meadows groundwater basin could yield sufficient make-up water below Vista on a periodic emergency basis. No other local groundwater basin has the capability. However, the Truckee Meadows groundwater basin is fully appropriated - the large wells primarily being owned by SPPCo for M & I peaking. This is expensive water and possibly could be considered in a temporary, intermittant emergency situation only. This option would require the Cities to recharge the Truckee Meadows Groundwater Basin with city owned surface rights by utilizing injection wells west of town.

V. REHABILITATION AND BETTERMENT IN THE TCID PROPOSED BY THE U.S. BUREAU OF RECLAMATION (USBR)

The writer is not familiar with the details of this program, however, it is understood that its' primary objective is to conserve water, and any water saved could possibly be managed to the benefit of the land disposal project.

POTENTIAL FOR UTILIZING UNUSED, PURCHASED EXCHANGED AND/OR OTHER WATER RIGHTS

In an effort to identify order-of-magnitude only water volumes available and costs, for flow augmentation, Table 4 was prepared. It should be emphasized that the estimates of potential volumes and costs in Table 4 are primarily for use as an initial aid in deciding a recommended order for the Cities to follow, i.e. "ranking" of sources according to potential, from which closer estimates and recommendations as to acquisition of water for flow augmentation will be made.

With the above in mind, plus all other information developed under EXISTING WATER RIGHTS and DISCUSSIONS WITH CONCERNED ENTITIES, the potential for utilizing unused, purchased, exchanged and/or other water rights is developed by the following discussions of the water rights aspects of the seven scenarios identified in the DRI study report. All scenarios will require the Cities filing secondary applications for conveyance, storage and use of the effluent.

TABLE 4

ROUGH, PRELIMINARY ESTIMATES OF WATER RIGHTS COSTS FOR LAND DISPOSAL

(COSTS OF MANAGING THESE RIGHTS - SUCH AS STAMPEDE ASSESSMENTS AND POWER FOR WELL PUMPS NOT INCLUDED)

Source	Estimated Amount Available - AF Annually	Computation of Approx. 1979 One-Time Cost to Acquire the Water Right - Dollars/AF	Total	Comments
Surface rights in SPPCo water service area	20,000	$150/AF	3,000,000	
Surface rights in & above Truckee Meadows - not in SPPCo service area	10,000	$750/AF	7,500,000	Most expensive because in most cases no other M&I water is available
Surface rights below Vista	2,000,---	$1000/AF	2,000,000	Most expensive because in most cases no other M&I water is available
Winter Hydro	20,000	8500 KW installed capacity @ 600/KW (app.) = $5,000,000 = 250/AF	5,000,000	
Wells	4000AF in two months (approx. 20 mgd Approx. 14,000 gpm)	6 approximately 2500 gpm wells at 200,000 = 1,200,000 = $300/AF. Double to include recharge works = $600/AF	2,400,000	Hydrological feasibility needs verifying
Better Management in the Truckee Meadows	Unknown - say 25,000 AF	8 additional operating people plus ancillary equipment, real estate and other misc. overheat at 50,000 ea = 400,000 additional per year - say capitalizes @ 4,000,000 = $160/AF	4,000,000	Remember, the Watermaster feels that probably negligible flow increase at Vista would occur.

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FIRST DODGE FLAT SCENARIO - LAND DISPOSAL AT DODGE FLAT

A prime advantage of Dodge Flat from a water rights standpoint is the existence of approximately 25,000 AF of unused Federally decreed, 1859 priority irrigation rights in the vicinity of Dodge Flat. These rights are as follows:

Unused bench lands rights which can be allocated to Dodge Flat	15,345 AF
An application to the State Engineer must be made to divert this water in the effluent pipeline	
Unused bottom lands rights which could be allocated to Dodge Flat, approximately	10,000 AF
An application to the State Engineer must be made to divert this water in the effluent pipeline and change the place-of-use to Dodge Flat (benchland)	
Total Approximately	25,000 AF

Secondary applications for storage will also be required.

The additional approximately 19,000 AF of water rights would have to be acquired for utilization of all of the effluent at Dodge Flat. Although rehabilitation and betterment in TCID and re-establishing vegetative cover along the lower River would yield water and should be pursued, purchase and transfer of the additional 19,000 AF appears to be the only practical approach. Referring to Table 1 herein, some rights are available below Derby Dam but not nearly enough. They perhaps could be purchased and transferred without drawing protests. The remaining water rights comprising most of the required 19,000 AF could be purchased above Derby Dam, however, any applications to the State Engineer to transfer are certain to be protested by TCID and other downstream interests unless greatly improved system management actions, satisfactory to all interests, are defined, approved and implemented.

If the figures are even remotely accurate, the option to purchase of the SPPCo winter hydro flows, alter the Floristan flow rates and "float" the water saved upstream utilizing better management of the storage would be the most viable source of the additional 19,000 AF needed for effluent disposal entirely at Dodge Flat. For instance

100 cfs "held" upstream through four winter months would result in an additional, approximately 23,000 AF in storage. However, although possibilities are reasonably good that this water would be utilized for flow augmentation (thus to TCID), TCID opposition to routing this water to Dodge Flat is certain.

SECOND DODGE FLAT SCENARIO - LAND DISPOSAL AT DODGE FLAT AND TCID

This option would involve a common pipeline from Vista to Wadsworth and separate line to Dodge Flat and the Fernley-Swingle Bench areas. From a water right standpoint, this option would result in the least amount of dispute in that the land developed for agriculture at Dodge Flat would replace land that is going or has gone out of production in the Fernley and Fallon area (approximately 5000 acres) and the land has a priority water right. The portion of the effluent (approximately one half) going to the Fernley-Swingle Bench area serve agricultural lands currently in production.

This option will enable TCID to store winter flows to Lahontan Reservoir from the Truckee River in upstream reservoirs and bring the water to Lahontan Reservoir throughout the summer because of the reduced summer demand from the Truckee Division in TCID. The higher summer flows to Lahonton Reservoir would improve late summer production in the Carson Division when the Carson River flows are typically low.

The summer flows to Lahontan Reservoir will solve the flow depletion problems faced by Reno and Sparks between Vista and Derby Dam if the sewage effluent is removed from the Truckee River. However, this option will require a change in the operating criteria for the Truckee River System and applications for changes in points of diversion.

Variations of this option, utilizing other mechanisms such as groundwater for flow augmentation are possible.

THIRD DODGE FLAT SCENARIO - COMBINATION LAND DISPOSAL AT DODGE FLAT AND RIVER DISCHARGE

This option would involve developing the Indian unused water rights of approximately 25,000 AF or some portion thereof at Dodge Flat and discharging the remainder when flows are high at Vista. Again, flow augmentation in low water years will be required.

FOURTH DODGE FLAT SCENARIO - COMBINATION LAND DISPOSAL AT DODGE FLAT AND DISCHARGE TO FERNLEY WILDLIFE AREA

This option would again involve developing the Indians unused water rights of approximately 25,000 AF, or a portion thereof, at Dodge Flat. New water rights would have to be acquired for the discharges to the Fernley Wildlife area which would theoretically deplete both Pyramid Lake and TCID. Even with much improved river system management these transfers would probably be protested.

FIRST FALLON AREA SCENARIO - PIPE THE EFFLUENT TO DERBY DAM

The only water rights problem with this option would be flow augmentation below Vista for which earlier options are discussed.

SECOND FALLON AREA SCENARIO - PIPE THE EFFLUENT TO AN EXISTING LOW LEVEL RESERVOIR IN TCID

Only rights for flow augmentation below Vista would be needed for this option.

THIRD FALLON AREA SCENARIO - PIPE THE EFFLUENT TO THE FERNLEY-SWINGLE BENCH AREA WITH TRUCKEE RIVER DISCHARGES AND PIPED EFFLUENT TO THE FERNLEY WILDLIFE AREA DURING THE NON-GROWING SEASON

This option would require new water rights for the discharges to the Fernley Wildlife areas - theoretically depleting both Pyramid Lake and TCID. Transfer of rights to the Fernley Wildlife area would probably be protested by TCID and the Indians. Flow rights for augmentation below Vista would also be required.

The last three options above - involving no effluent going to Dodge Flat would probably be opposed by the Indians.

Reno-Sparks Joint Water Pollution
Control Plant Master Project

Draft Environmental Impact Statement

Appendix D

Cultural Resources Surveys

June 1980

Prepared For:

U. S. Environmental Protection Agency
Region IX

D-0

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PRELIMINARY REPORT

Cultural Resources Survey of The Proposed Reno-Sparks Sewage Effluent Study

Submitted to: Jones & Stokes Associates, Inc.
2321 P Street
Sacramento, CA 95816

Submitted by: Board of Regents
University of Nevada System
Desert Research Institute
Social Sciences Center
P.O. Box 60220
Reno, NV 89506

by

Elizabeth Budy

June 14, 1979

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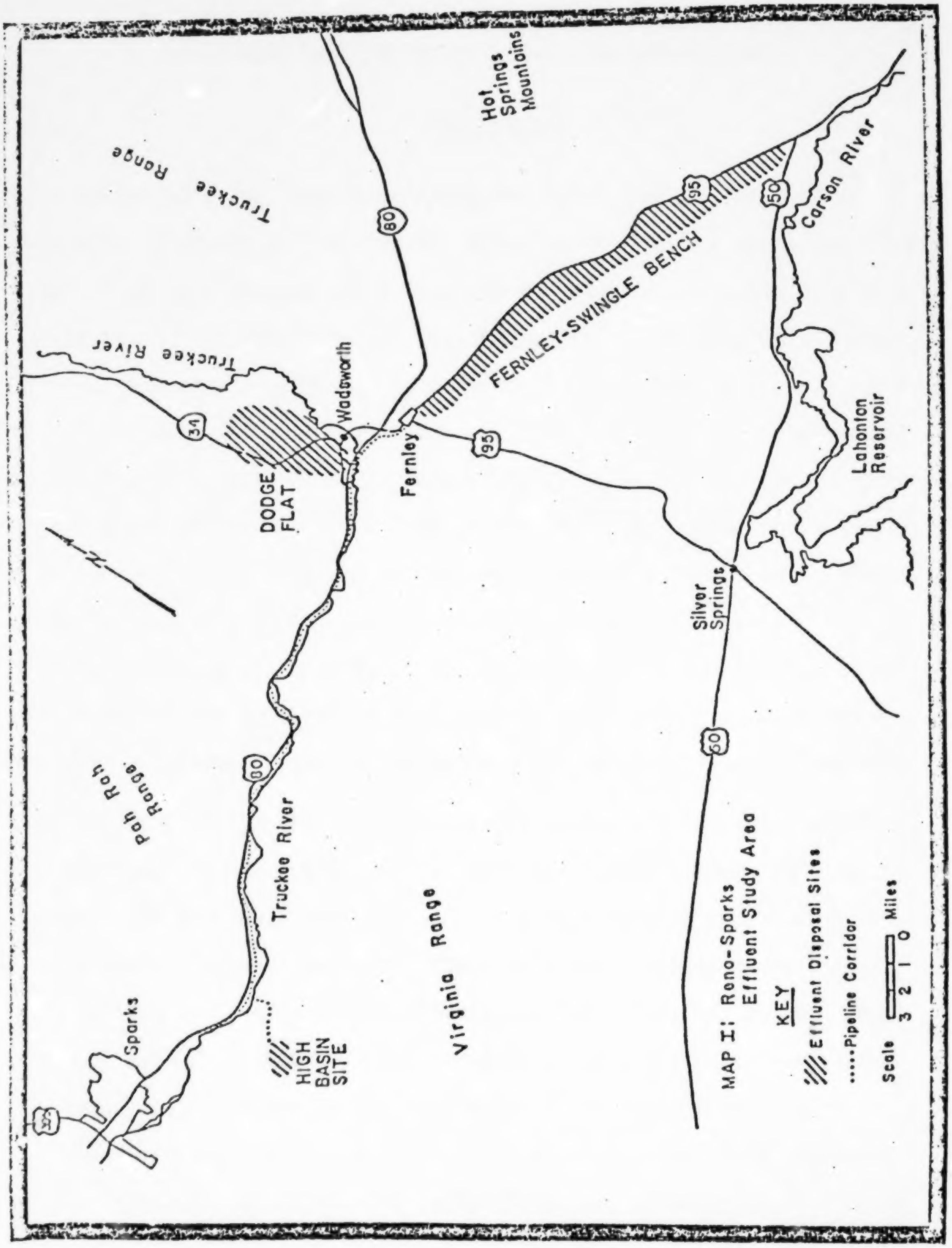
A PRELIMINARY CULTURAL RESOURCES SURVEY OF THE PROPOSED RENO-SPARKS SEWAGE EFFLUENT STUDY

INTRODUCTION

Under agreement with Jones and Stokes Associates, Inc., Sacramento, California, the Social Sciences Center, Desert Research Institute, conducted a cultural resources survey of ten percent of the proposed Reno-Sparks Sewage Effluent study area. The project area includes three distinct effluent disposal sites, the Dodge Flat site north of Wadsworth, the Fernley-Swingle Bench area in the Lahontan Valley, and the High Basin site, a small valley south of Lockwood. It also includes approximately 27 miles of pipeline corridor, a long section of which follows the Truckee River, from the Sewage Treatment Plant east of Sparks to the town of Fernley. Another short section of line runs from the Truckee River at the confluence of Long Valley Creek, south of the High Basin site. The location of the project subareas are delineated on Map I. Further discussion of the areal and environmental characteristics of the areas are provided below, under "Sampling Methodology."

The field survey was conducted between May 1 and May 22, 1979. A total of ten days (168 man hours) were spent in the field; however, the field period was interrupted by a delay in obtaining permission from the Pyramid Lake Indians to survey reservation lands. The archaeological survey of Dodge Flat was authorized by the Pyramid Lake Paiute Tribal Council in a letter from the Tribal Council Chairman, James Vidovich, dated May 10, 1979.

Prior to going into the field, a site records search was conducted at the Nevada State Museum in Carson City. Previously recorded sites were plotted on the U.S.G.S. quad sheets taken into the field. Whenever possible,



MAP I: Reno-Sparks Effluent Study Area

KEY
Effluent Disposal Sites
Pipeline Corridor
Scale 3 2 1 0 Miles
N
Truckee Range
Hot Springs Mountains
Truckee River
Wadsworth
DODGE FLAT
Fernley
FERNLEY-SWINGLE BENCH
Carson River
Lahontan Reservoir
Silver Springs
Pah Rah Range
Virginia Range
Sparks
HIGH BASIN SITE
80
34
95
50
395

previously recorded sites were located and examined in the field. A systematic literature search of historic places was conducted concurrently with and after the field survey. The National Register of Historic Places, issued on February 6, 1979, was consulted for any previous listings. Only one site in the project area, Derby Dam, has been nominated to date.

The field survey was directed by Elizabeth Budy and Lonnie Pippin. Crew members included Lorena Stookey, Carolyn Pippin, and Donald Zerga. Donald Zerga also participated in the site records search and in the preparation of the historical background. The final report was written by Elizabeth Budy. Donna Chouteau drafted the project maps and assisted in the preparation of the final report. Lonnie Pippin acted as Principal Investigator.

The field methodology and sampling design are described below.

General Sampling Methodology

The Reno-Sparks Effluent Study encompasses five spacially and environmentally distinct project areas, involving both pipeline corridor and effluent disposal sites. A separate sampling strategy, therefore, was developed for each of the project sub-areas, each developed according to the particular environmental characteristics of these areas.

The project was initially segregated according to pipeline versus effluent disposal sites. The subareas include two sections of pipeline corridor, the Truckee River line and the High Basin line, and three proposed effluent disposal sites, Dodge Flat, Fernley-Swingle Bench, and High Basin site. All five subareas were sampled separately.

At least ten percent of each area was intensively surveyed by two crew members walking systematic transects at ten meter spacing intervals. Whenever possible, sampling units within each separate area were made of comparable size.

Sample units, however, were expanded when the boundaries of an archaeological site extended beyond the arbitrary limits of the sampling area. Conversely, they were contracted in size when aspects of the topography or serious land disturbances made a larger sample unit unfeasible. When the initial ten percent total area sample was deemed inadequate for making a fair estimation of the archaeological site potential of an area, the total percent sample was increased. The degree of increase varied in each area according to local conditions of ground visibility and access. The most important factor affecting ground visibility involved the degree and kind (agricultural, industrial, or residential development) of land disturbances. This was an important consideration in the sample selection since such land disturbances may destroy or obliterate archaeological surface remains. Hence, sample units were selected in minimally disturbed areas whenever accessible.

The environmental setting and sampling methodology for each of the five areas, is provided below. Sampling units have been plotted on maps drawn from U.S.G.S.15 minute quads, designated IIIa through IIIh, and are included as Appendix A.

Truckee River Pipeline Corridor

The Truckee River Pipeline Corridor involves approximately 27 linear miles paralleling the river from the Sewage Treatment Plant west of Reno to the Wadsworth-Fernley area. The corridor is confined to the river valley which varies in width from about 300 feet near the Washoe-Storey county line to over a mile wide near Wadsworth. The corridor is flanked by the Pah Rah Range on the north and the Virginia Range on the south. Sediments in the valley include stream deposits, talus, slope wash, alluvial fan, and aeolian deposits (Bonham 1969:Map). Outcrops of basalts and rhyolitic rock associated with the Peavine Sequence occur sporadically at the edges of the river in the western, narrow part of the Truckee canyon (Bonham 1969:Map). Many of these outcrops contain prehistoric petroglyphs and pictographs (Heizer and Baumhoff 1962:61-71).

Vegetation in the valley is quite diverse. Riparian communities include sedges and rushes (*Phragmites* sp., *Scirpus* sp., *Typha* sp., and *Carex* sp.), cottonwoods (*Populus* spp.) and willows (*Salix* spp.). The floodplain and alluvial slopes support a mosaic of sagebrush (*Artemisia* spp.), rabbitbrush (*Chrysothamnus* spp.), saltbush (*Atriplex* spp.), and greasewood (*Sarcobatus vermiculatus*).

The Truckee River Valley has been intensively developed for agricultural, industrial, and residential purposes. Selection of sample units was hence seriously constrained by private land ownership, limited access, and widespread land disturbances. The first consideration in the sampling design was to delimit accessible areas of light disturbance with good archaeological site potential. Therefore, sample units were selected in low impact areas to include a cross-section of the topographic variability in the valley, defined on the basis of major landform types. The landforms were: marsh, floodplain, rock outcrops, knoll, and river terrace. Several small sections of pastureland were also included for purposes of control.

Initially, ten percent of the total linear length of the corridor was sampled. Sampling units, 0.6 miles long by 0.2 miles wide, were selected for each six miles of pipeline corridor with the long axis of the unit paralleling the river. A total of five such units, or 384 acres, was intensively surveyed. The Truckee River Pipeline units are letter and number coded, proceeding from west to east along the river, i.e., PL-1, PL-2, ..., PL-5. Because the number of archaeological sites was lower than expected, three additional smaller sampling areas (0.25 mile long by 0.15 miles wide) were also intensively surveyed. These units are designated by a two-part letter code, i.e., PL-A, PL-B, PL-C. The location of the sampling units has been plotted on maps IIIa through IIIe (Appendix A).

A description of the Truckee River pipeline sampling units is given below. The following information is provided for each unit:

1. U.S.G.S. Topographic Quad: Sheet reference and map number (Appendix A)
2. Location: Legal description of area
3. Area: Total area surveyed, given in both miles north/south and east/west and as well as total acreage.
4. Elevation: Feet above sea level
5. Topographic Setting: Landform associations of the sampling area.
6. Vegetation: Vegetation types occurring within the sampling area.
7. Disturbance: Description of the agricultural, industrial, recreational, or residential land disturbances in the sampling area.
8. Cultural Resources: A list of recorded historic and prehistoric sites, as well as isolated cultural materials noted within or adjacent to the sampling area.

Description of Sampling Units

Truckee River Pipeline Section

PL-1. USGS Quad: Vista 7.5' and Spanish Springs Valley 15' (Map IIIa)
Location: T.19N./R.20E. NE of NW¼, W½ of NE Sec. 13; SE of SW Sec. 12
Area: 0.6 mile EW/0.25 mile NS (80 acres) 400 m NS/760 m EW
Elevation: 4380'
Topographic Setting: Unit is located at a point where the Truckee River floodplain narrows to about 300 feet. The sampling unit includes the floodplain on both sides of the river as well as the colluvial slopes and knolls to the south.
Vegetation: Greasewood (*Sarcobatus vermiculatus*) and cheatgrass (*Bromus tectorum*) are predominant on the floodplain, with sporadic occurrences of salt desert shrub (*Atriplex* spp.), ricegrass (*Oryzopsis hymenoides*) and service berry (*Amelanchier* sp.). Sagebrush (*Artemisia tridentata*) and rabbitbrush (*Chrysothamnus* sp.) cover the north slopes of river bank, with willows at the river edge.
Disturbances: The valley botton has been much disturbed by road, bridge, and railroad construction. Both valley bottom and side slopes have been heavily grazed by cattle.
Cultural Resources: A previously recorded petroglyph site, 26Wa2, is located on a rock outcrop on the north side of the river.

PL-A. USGS Quad: Spanish Springs Valley 15' (Map IIIa)
Location: T.19N., R.21E., SE of SE¼ Sec. 18; SW¼ of SW¼ Sec. 17
Area: 0.25 mile EW/0.15 mile NS (24 acres)
Elevation: 4360' - 4420'
Topographic Setting: Floodplain, rock outcrops, and alluvial fan on south side of Truckee River.
Vegetation: Sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus* sp.) and cheatgrass (*Bromus tectorum*) on slopes; cottonwoods (*Populus* sp.) and willows (*Salix* sp.) adjacent the river (Baumhoff and Heizer 1962:63).
Disturbances: Intensive cattle grazing, jeep trail, small diversion dam, and recent camping litter.
Cultural Resources: One isolated, unmodified chert flake and bits of historic bottle glass were noted. No sites were recorded.

PL-B. USGS Quad: Spanish Springs 15' (Map IIIb)
Location: T.19N., R.21E., NE¼ of NE¼ of Sec. 19; NW¼ of NW¼ of Sec.20
Area: 0.25 mile EW/0.15 mile NS (24 acres)
Elevation: 4600' - 4660'
Topographic Setting: Flat knoll tops and saddle in Virginia Range overlooking Truckee River.
Vegetation: Sagebrush (*Artemisia tridentata*), rabbitbursh (*Chrysothamnus* sp.), Mormon tea (*Ephedra* sp.) cover the knoll tops, with cheatgrass (*Bromus tectorum*) and unidentified flowering forbs predominant on saddle.
Disturbances: Cattle grazing and jeep trail through area.
Cultural Resources: No cultural resources were noted.

PL-2. USGS Quad: Spanish Springs Valley 15' (Map IIIc)
Location: T.19N., R.21E., SE¼ of NE¼ Sec. 16, N½ of NW¼ Sec. 15
Area: 0.6 mile EW/0.2 mile NS (76.80 acres)
Elevation: 4380' - 4420'
Topographic Setting: Low rocky knolls and sandy flats in Truckee River floodplain.
Vegetation: Cheatgrass (*Bromus tectorum*) and miner's lettuce (*Montia perfoliata*) are the dominant vegetation types with a few shrubs (sagebrush and Mormon tea) on the knoll tops.
Disturbances: Most of the river valley in the Mustang-Hafed area is currently under agricultural or residential development.
Cultural Resources: Recorded one small material workshop site (26Wa2679) on north slopes of one knoll. Noted 2 isolated obsidian flakes at extreme western end of sampling unit. A previously recorded petroglyph site, 26Wa1601, is located directly south of sampling unit. Also Site Wa2131, petroglyphs, is 1.5 mile east.

PL-3. USGS Quad: Spanish Springs Valley 15' (Map IIIc)
Location: T.19N., R.22E., NE¼ Sec. 6; T.20N., R.22E., SE¼ of Sec. 31
Area: (Irregular) 0.6 mile EW, maximum 0.4 mile NS (128 acres)
Elevation: 4280'
Topographic Setting: Flats and gentle slopes of river floodplain adjacent old oxbow on south side of the Truckee River.
Vegetation: Big sagebrush (*Artemisia tridentata*) is the dominant vegetation, with some rabbitbrush (*Chrysothamnus* sp.), ricegrass (*Oryzopsis hymenoides*),

and cheatgrass (Bromus tectorum). Cottonwoods (Populus sp.) and willows (Salix sp.) grow along the river edge.
Disturbance: Heavily grazed by cattle.
Cultural Resources: One prehistoric campsite, 26St27, was recorded in the dunes at the edge of the river and on the top of a low, rocky knoll. A previously recorded site, 26St5, is located 1 mile to the northeast.

PL-C. USGS Quad: Wadsworth 15' (Map IIId)
Location: T.20N., R.22E., S½ of SW¼ Sec. 26
Area: 0.25 EW/0.15 NS (24 acres)
Elevation: 4240'
Topographic Setting: Floodplain on north side of Truckee River. Some pastureland included for sample control.
Vegetation: Mixed community, including greasewood (Sarcobatus vermiculatus), rabbitbrush (Chrysothamnus sp.), sagebrush (Artemesia tridentata), serviceberry (Amelanchier sp.), saltgrass (Distichlis stricta), cottonwoods (Populus sp.), and willows with alfalfa in the pasturelands.
Disturbance: Heavily disturbed by cultivation and grazing.
Cultural Resources: Bits of historic bottle glass and one prehistoric basalt flake noted. No sites recorded.

PL-4. USGS Quad: Wadsworth 15' (Map IIId)
Location: T.20N., R.23E., NW¼ of Sec. 19
Area: 0.6 mile EW/0.2 mile NS (76.80 acres)
Elevation: 4200'
Topographic Setting: Marsh and pasturelands in the Truckee floodplain north and east of Derby Dam.
Vegetation: Marsh vegetation includes: common reeds (Phragmites communis), bulrush (Scirpus sp.), sedges (Carex sp.), saltgrass (Distichlis stricta), willows (Salix sp.), and cottonwoods (Populus sp.). Also noted were: sagebrush (Artemisia tridentata), greasewood (Sarcobatus vermiculatus), and wild rose (Rosa sp.), with alfalfa and clover in the pasturelands.
Disturbance: Area has been disturbed by railroad, dam, and road construction as well as agricultural land development.
Cultural Resources: Bits of historic bottle glass are scattered in the old stand of cottonwoods. One historic dump site was recorded (26Wa2677) next to the railroad.

PL-5. USGS Quad: Wadsworth 15' (Map IIIe)
Location: T.20N., R.23E., NE¼ of Sec. 13; T.20N., R.24E., NW¼ of NW¼ of Sec. 18
Area: 0.6 mile EW/0.2 NS (76.80 acres)
Elevation: 4200' - 4280'
Topographic Setting: Old river terraces of exposed lake sediments and gentle lower alluvial slopes north of the Truckee River.
Vegetation: Mixed salt desert shrub community including greasewood (Sarcobatus vermiculatus), sagebrush (Artemesia tridentata), saltbrush (Atriplex spp.), rice grass (Oryzopsis hymenoides), cheatgrass (Bromus tectorum) and Russian thistle (Salsola kali).
Disturbance: Area has been disturbed by grazing.
Cultural Resources: No cultural resources were noted. Severe erosion of fine lake sediments of the terraces may have obscured any cultural resources present.

High Basin Pipeline Corridor

The High Basin Pipeline is a short section of line, approximately 2.5 miles long, which takes off from the Truckee River at Lockwood, proceeding from thence south, southwest to the High Basin Effluent Site. Elevations range from 4360 feet in the Truckee Floodplain to 5000 feet at head of the ravine where the pipeline feeds into the High Basin disposal site.

The area traversed by the proposed pipeline is environmentally diverse and geologically complex. From the Truckee River floodplain at Lockwood, the pipeline follows the ephemeral channel of Long Valley Creek in Lagomarsino Canyon for 0.5 mile. The bottom of the canyon consists of Pleistocene and recent stream deposits, slope wash, and aeolian deposits; however, two outcrops of Pleistocene basalt and andesite flows, underlain by Pliocene basalt and sedimentary rocks, flank the mouth of Lagomarsino Canyon (Bonham 1969; Map). The upper, southern section of the pipeline corridor turns southwest from Long Valley Creek up a steep-sided, unnamed ravine. The terrain at the mouth of the ravine is very irregular, with gentle knolls cut by low washes interspersed with occasional historic dune formations. Bedrock is affiliated with the Kate Peak Formation, consisting of andesitic and rhyodacitic tuffs, breccias, and conglomerates with intercalated sedimentary lenses (Bonham 1969; Map).

Vegetation along the route includes riverine, cottonwood-willow communities, salt desert shrub and sagebrush associations,and pinyon-juniper stands. A small isolated stand of ponderosa pine also occurs on the hydrothermally altered soils on the side slopes of the unnamed ravine. The major vegetation types noted along the corridor include: ponderosa pine (*Pinus ponderosa*), pinyon (*Pinus monophylla*), juniper (*Juniperus occidentalis*), cottonwood

(*Populus* sp.), willow (*Salix* sp.), greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* spp.), rabbitbrush (*Chrysothamnus* spp.), sagebrush (*Artemisia* spp.), service berry (*Amelanchier* sp.), Mormon tea (*Ephedra* sp.), sunflower (*Balsamorhiza* sp.) and cheatgrass (*Bromus tectorum*).

Approximately 35 percent (100.80 acres) of the pipeline corridor was surveyed. Two sampling units, designated HB-1 and HB-2, were placed at the upper, southern end of the corridor in the region of greatest topographic diversity where archaeological site potential seemed highest. Two prehistoric sites, 26St25-26, and one historic site, 26St31, were recorded in the survey areas. Each sample unit is described below, giving the same locational and environmental information as provided for the Truckee Pipeline units (p. 6) (Map IIIb, Appendix A).

High Basin Pipeline Corridor

HB-1. USGS Quad: Steamboat 7.5' (Map IIIb)
Location: T.19N., R.21E., SW¼ of SW¼ Sec. 20, NE¼ of NE¼ of Sec. 30
Area: 0.6 mile NS/0.2 mile EW (76.80 acres)
Elevation: 4700' - 4780'
Topographic Setting: Low rolling knolls and washes at the head of steep-sided ravine.
Vegetation: Pinyon (*Pinus monophylla*), juniper (*Juniperus occidentalis*), sagebrush (*Artemesia tridentata*), rabbitbrush (*Chrysothamnus* sp.), Mormon tea (*Ephedra* sp.), serviceberry (*Amelanchier* sp.), miner's lettuce (*Montia perfoliata*), rice grass (*Oryzopsis hymenoides*), cheatgrass (*Bromus tectorum*), and low sunflower (*Balsamorhiza* sp.).
Disturbance: The area is lightly littered with recent metal and paper debris, and there is a recent fenced reservoir adjacent the road. Cattle and sheep grazing is also apparent in area.
Cultural Resources: Two isolated chert flakes were noted. One historic stone structure was recorded as 26St31

HB-2. USGS Quad: Steamboat 7.5' (Map IIIb)
Location: T.19N., R.21E., SE¼ of NE¼ of Sec. 30
Area: 0.25 mile NS/.15 mile EW (24 acres)
Elevation: 4900' - 5068'
Topographic Setting: Knoll tops and slopes, saddle, wash and dunes.

(HB-2 - cont.)

Vegetation: Pinyon (*Pinus monophylla*), juniper (*Juniperus occidentalis*), sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus* sp.), serviceberry (*Amelanchier* sp.), Mormon tea (*Ephedra* sp.), ricegrass (*Oryzopsis hymenoides*), and cheatgrass (*Bromus tectorum*).
Disturbance: Road building, mining exploration, and cattle grazing in area.
Cultural Resources: Two prehistoric sites, 26St25-26, recorded in sampling area.

High Basin Site South of Lockwood

The proposed High Basin Effluent Disposal site is located in the Virginia Range approximately 1.5 miles south of Lockwood and 2 miles east of Reno in Storey County. The disposal site consists of a small valley, about 1 square mile in area. Elevations in the project area range from 5000 to 5200 feet, however, slopes to the west and east rise sharply above the valley to 5700 feet.

Soils in the center of the area consist of Pleistocene stream deposits, talus, slope wash, alluvial fan, and aeolian deposits (Bonham 1969). The Pliocene Kate Peak Formation also outcrops in the area. As described by Bonham (1969; map), it consists of flows, tuff, and mud flow breccia, agglomerate, volcanic conglomerate and associated intrusives ranging in composition from pyroxene andesite to rhyodacite. It also includes intercalated sedimentary lenses of diatomite, shale, sandstone, conglomerate and waterlain tuff.

Though the valley is very limited in area, it includes considerable geologic and micro-environmental variety. Numerous low knolls rise out of the valley floor. Some are intrusive volcanic flow outcrops, others are covered with alluvial rubble including cobble and boulder-sized chunks of knappable chert. A low, wide wash meanders along the eastern side of the valley, exposing additional alluvial deposits. Historic sand dunes have accumulated at the edge of the wash in the extreme northeast and southeast corners of the project area. On the west, the area consists of gentle to moderate alluvial-colluvial slopes with sporadic andesitic and tuff outcrops.

Vegetation in the valley is predominantly sagebrush (*Artemisia tridentata*), interspersed with sporadic juniper scrub (*Juniperus occidentalis*) on the knoll tops and a few isolated pinyon (*Pinus monophylla*) in the extreme northeast and southwest corners of the valley. Other species in the valley include: rabbitbrush (*Chrysothamnus* sp.), Mormon tea (*Ephedra* sp.), saltbush (*Atriplex* spp.), cheatgrass (*Bromus tectorum*) and very small amounts of rice grass (*Oryzopsis hymenoides*).

In general, and with the exception of a recent borrow pit and road construction in the center of the valley, the valley has been only lightly impacted. Cattle grazing is evident throughout the valley. Since the area has been subject to only light disturbances, it was not a major factor in the development of the sampling design.

The most important factor in developing the sampling methodology was the micro-environmental variety of the High Basin valley; therefore, a systematic transecting procedure was implemented to intersect zones of topographic and environmental variety. The area was systematically transected, generally from east to west, intersecting side slopes, valley bottom, knoll outcrops, washes, and sand dunes. Two persons, spaced ten meters apart, walked ten transect lines across the area. The locations of these units are indicated on Map IIIb, Appendix A. Transects are letter and number designated, proceeding from north to south, i.e., TR-1, TR-2, ..., TR10. Because of the limited size of the area, each transect cuts across a number of similar vegetation and topographic zones. Therefore, separate descriptions of each transect are not provided.

The naturally-occurring chert provided an important lithic material source for the prehistoric inhabitants of the area. Four prehistoric sites, all with evidence of quarrying and tool manufacturing, were recorded in the area. They are 26St28-26St30 and 26St51 (previously recorded). Another large prehistoric site, 26St50, was previously recorded near the small dry lake in the valley directly south of the project area.

Dodge Flat Effluent Disposal Site

The geology of Dodge Flat reflects the history of Pleistocene Lake Lahontan. According to Bonham (1969:Map), soils consist of lake deposits, clay, silt, sand, gravel and calcareous tufa. Some areas are thinly veneered by aeolian sand. Rocks belonging to the Miocene Pyramid Sequence, consisting of basalt, andesite, and dacite flows with lenses of silicic waterlain tuff, shales, and sandstones, outcrop in the southwest corner of the project area. Stream and aeolian deposits characterize the floodplain of the Truckee River.

Vegetation in the area is diverse, depending upon local microenvironmental conditions. Cottonwoods (*Populus* sp.), willows (*Salix* spp.), and buffaloberry (*Shepherdia arguta*) line the riverplain while greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* spp.) and grasses (*Bromus tectorum*, *Oryzopsis hymenoides*) are most conspicuous on the lake deposits. Sagebrush (*Artemisia* spp.) communities occur wherever local conditions are favorable, as in the well drained river and wash bottoms.

Human disturbances in the area are moderate compared to the other project subareas. Evidence of cattle grazing is apparent all over Dodge Flat; however, only parts of the Truckee River floodplain have been intensively developed for agriculture and as pasturelands. Industrial and residential development is likewise restricted and is primarily confined to the immediate Wadsworth vicinity. Human disturbances, consequently, did not prominantly figure into the development of the sampling design.

The Dodge Flat Effluent Disposal Site involves approximately 6906 acres in the sandy flats north of Wadsworth and west of the Truckee River (Map IIIf, Appendix A). Approximately 710 acres, or ten percent of the area, was surveyed. Five sample units, each 0.6 mile long by 0.3 wide, were surveyed. The project area was initially stratified according to land forms with expected high archaeological site potential, i.e., river terrace, lake terrace, floodplain, dry lake, promontories (knolls), and flats. Survey units were then placed so as to intersect each of these major landform types. Three prehistoric sites, 26Wa2678, 26Wa2680, 26Wa2681, and one historic site, 26Wa2682, were recorded in the survey areas. A description of each sampling unit, designated DF-1 through DF-5, according to criteria established above (p. 6) is provided below.

Dodge Flat Sampling Units

DF-1 USGS Quad: Wadsworth 15' (Map IIIf)
Location: T.21N., R.24E. SW¼ of section 32
Area: 0.6 mile NS/0.3 mile EW (142 acres)
Elevation: 4200' - 4323'
Topographic Setting: Northwestern slopes and top of a basalt-covered knoll which rises sharply out of the flats one mile northwest of Wadsworth. The bottoms and edges of a playa to the west were also surveyed.
Vegetation: The playa is barren of vegetation, though greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* spp.), and ricegrass (*Oryzopsis hymenoides*) occur along the edges of the playa and on the knoll.
Disturbances: Recent dumping and road construction in area.
Cultural Resources: Some scattered fragments of historic bottle glass were noted. No sites were recorded.

DF-2 USGS Quad: Wadsworth 15' (Map IIIf)
Location: T.20N., R.24E., N½ of SE¼ and NE¼ of Section 5
Area: 0.6 mile NS/.3 mile EW (142 acres)
Elevation: 4160' - 4240'
Topographic Setting: Tops of ancient lake terrances and washes in stream-dissected area one mile southwest of Wadsworth.

(DF-2 - cont.)

Vegetation: Greasewood (*Sarcobatus vermiculatus*) is the dominant vegetation on the tops of the lake terraces but sagebrush (*Artemisia tridentata*) occurs in the wet bottoms of the washes. Other vegetation in the area includes rabbitbrush (*Chrysothamnus* sp.), saltbush (*Atriplex* spp.), cheatgrass (*Bromus tectorum*), rice grass (*Oryzopsis hymenoides*) and Russian thistle.

Disturbance: A road and powerline intersect the north edge of the survey unit, and there has been some recent dumping in the wash adjacent the road. More serious than the human disturbances is the severe water and wind erosion in the area which may obscure subsurface cultural materials.

Cultural Resources: One isolated large, unmodified basalt flake was observed in the bottom of a wash. No sites were recorded.

DF-3 USGS Quad: Wadsworth 15' (Map IIIf)

Location: T.21N., R.24E., W½ of NE¼, NE¼ of NW¼ of Section 33; SE¼ of SW¼ of Section 28.

Area: 0.6 mile NS / 0.3 mile EW (142 acres)

Elevation: 4040' - 4080'

Topographic Setting: Truckee River floodplain at edge of lowest river terrace.

Vegetation: Vegetation includes cottonwood (*Populus* sp.), silver buffaloberry (*Shepherdia argenta*), sagebrush (*Artemisia tridentata*), greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex confertifolia*), miner's lettuce (*Montia perfoliata*), and salt grass (*Distichlis stricta*).

Disturbance: Areas immediately adjacent to sampling unit have been agriculturally developed and parts of the area have been used for refuse disposal.

Cultural Resources: One prehistoric site, 26Wa2680, was recorded.

DF-4 USGS Quad: Wadsworth 15' (Map IIIf)

Location: T.21N., R.24E., NE¼, E½ of NW¼ and N½ of SE¼ of Section 28.

Area: 0.6 mile EW / 0.3 mile NS (142 acres)

Elevation: 4020' - 4160'

Topographic Setting: Floodplain and river terraces west of the Truckee River.

Vegetation: The floodplain has been planted in alfalfa and otherwise includes only a few isolated cottonwoods (*Populus* sp.). Vegetation on the river terraces is sparse, but includes greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* spp.), cheatgrass (*Bromus tectorum*), and rice grass (*Oryzopsis hymenoides*).

Disturbance: The floodplain has been agriculturally developed. There is some evidence of cattle grazing on the terraces.

Cultural Resources: One prehistoric site, 26Wa2681, and one historic site, 26Wa2682, were recorded.

DF-5 USGS Quad: Wadsworth 15' (Map IIIf)

Location: T.21N., R.24E., E½ of SW¼ of Section 16; NE¼ of NW¼ and NW¼ of NE¼ of Section 21.

Area: 0.6 mile NS / 0.3 mile EW (142 acres)

Elevation: 4040' - 4140'

Topographic Setting: Sampling unit cuts across Gardella Canyon, and sandy flats and small dry lake in Dodge Flat.

Vegetation: Vegetation throughout the area is generally sparse, consisting of greasewood (*Sarcobatus vermiculatus*) and saltbush (*Atriplex* spp.); however, rice grass (*Oryzopsis hymenoides*) is particularly abundant.

Disturbance: The area is only lightly disturbed by cattle grazing, with some limited evidence of hunting and motorcycle riding.

Cultural Resources: One prehistoric site, 26Wa2678, was recorded.

Fernley-Swingle Bench Irrigation Area

The proposed Fernley-Swingle Bench Irrigation area involves a narrow corridor approximately 1.5 miles wide by 17 miles long between Fernley and Swingle Bench. The sub-area is flanked by the Virginia Range on the north and the Truckee and Hot Springs ranges on the south. It is bounded on the east by the Carson Desert with its irregular configuration of playas, dunes, and sloughs. The area consists of gentle, rolling terrain, remnants of Lake Lahonton beach terraces, dunes, and alkalai flats. The area is characterized by Quaternary sediments including Lake Lahontan deposits, alluvial fan materials, and wind-blown sand (Willden and Speed 1974:28, Plate 1). Also included within the area are numerous, small wet marshes and a series of seep springs.

Vegetation consists of salt desert shrub community, with greasewood (*Sarcobatus vermiculatus*) as the most conspicuous representative. Saltbush (*Atriplex* spp.), salt grass (*Distichlis stricta*), cheatgrass (*Bromus tectorum*), and occasionally rice grass (*Oryzopsis hymenoides*) and sagebrush (*Artemisia* spp.) also occur. Various rushes and sedges (*Phragmites* sp., *Scirpus* sp., *Typha* sp., and *Carex* sp.) occur in the marshes and around the seep springs. Overall vegetation cover is very light, however, and many areas are completely barren.

The Fernley-Swingle Bench area has been intensively developed for agriculture since the early 1900's with the construction of the Truckee Canal. Approximately 60 percent of the project area is presently under irrigation. There is also considerable land disturbance due to residential construction and industrial (gravel pits) activities.

The sampling design was adjusted to segregate out areas of high land disturbance. Pasturelands, irrigated lands, and other seriously disturbed areas were delineated on U.S.G.S. quads and deleted from the sample. The remaining area was stratified according to major landform types, i.e., marsh, spring, dune, terrace, alkalai flat, alluvial fan, and volcanic or tufa outcrops. Each landform type was then sampled. Survey units were selected to cut across several landform types.

A total of 1280 acres, or ten percent of the total area, was surveyed. Sample units of no less than .5 mile square were intensively covered. Larger areas were surveyed when archaeological sites in these areas extended beyond the limits of the sampling units. Three prehistoric sites, 26Ch583-585, were recorded in the sample units. Several other prehistoric sites (26Ly62, 26Ch62, 141, 477) have been previously recorded within or adjacent to the project area. Each of the six sampling units is letter and number coded, proceeding from west to east, i.e., SB-1 through SB-6. Descriptions of each unit according to criteria established above (p. 6) is provided below. Sampling units have plotted on Maps IIIg - IIIj (Appendix A).

Fernley-Swingle Bench Sampling Units

SB-1. USGS Quad: Two Tips 15' (Map IIIg)
Location: T.20N., R.25E., SE¼ of SW¼, SW¼ of SE¼, Sec. 15, NE¼ of NW¼, NW¼ of NE¼, Sec. 22
Area: 0.5 mile NS/0.5 mile EW (160 acres)
Elevation: 4100' - 4120'
Topographic Setting: Terraces cut by low washes and alkalai flats adjacent marshy area.
Vegetation: Greasewood is the dominant and almost only vegetation with some saltgrass (*Distichlis stricta*) and saltbush (*Atriplex* sp.). The tops of the benches (lake terraces) are devoid of vegetation.
Disturbance: Cattle grazing in area. Land directly to the south has been agriculturally developed. Alternate Highway 95 and the Southern Pacific Railroad cut across the area.
Cultural Resources: No cultural resources were noted; however, natural erosion of all lake sediments is severe and may obscure subsurface materials.

SB-2. USGS Quad: Two Tips 15' (Map IIIh)
Location: T.20N., R.26E., SW¼ Sec. 19
Area: 0.5 mile NS/0.5 mile EW (160 acres)
Elevation: 4120' - 4160'
Topographic Setting: Low terraces intersected by washes.
Vegetation: Greasewood (*Sarcobatus vermiculatus*) and saltbush (*Atriplex* sp.) are the dominant vegetation types with a few cottonwoods (*Populus* sp.) growing in the washes. No plants grow on the tops of the terraces.
Disturbance: Cattle grazing and road construction in the area. Adjacent agriculturally developed land, irrigation canal, and gravel pits.
Cultural Resources: No cultural resources were noted; however, natural erosion of lake sediments may obscure subsurface materials.

SB-3. USGS Quad: Two Tips 15' (Map IIIh)
Location: T.20N., R.26E., SW¼ of Sec. 28
Area: 0.5 mile NS/0.5 Mile EW (160 acres)
Elevation: 4040' - 4120'
Topographic Setting: Long, basalt-capped, finger ridge adjacent tufa outcrops and marshy area.
Vegetation: Vegetation on ridge top is very sparse, consisting almost exclusively of saltbush (*Atriplex* spp.) and Russian thistle. A great variety of grasses, including saltgrass (*Distichlis stricta*) and greasewood (*Sarcobatus vermiculata*) grow in and around the marshy flats.
Disturbance: A road cuts EW across the top of the ridge. The Southern Pacific Railroad, Alternate Hwy 95, and a small irrigation canal run along the southern edge of the sampling unit. Cattle grazing in area.
Cultural Resources: A small prehistoric lithic workshop site, 26Ch585, was recorded at the base of a small tufa outcrop, directly south of the ridge. Two previously recorded sites, 26Ch141 and Ch162, are located one mile to the northeast

SB-4. USGS Quad: Two Tips 15' (Map IIIh)
Location: T.19N., R.26E., SE¼ of NE¼, NE¼ of SE¼ Sec. 3; SE¼ of NW¼, NW¼ of SW¼ Sec. 2
Area: 0.5 mile/0.5 mile (160 acres)
Elevation: 4070' - 4160'
Topographic Setting: Top and slopes of basalt-covered knoll
Vegetation: Saltbrush (*Atriplex* spp.) and some cheatgrass (*Bromus tectorum*)
Disturbance: Cattle grazing and motorcycling in area.
Cultural Resources: No cultural resources were noted.

SB-5. USGS Quad: Two Tips 15' (Map IIIh)
Location: T.19N., R.26E., E½ Section 2
Area: 0.5 mile EW/1.0 mile NS (320 acres)
Elevation: 4040' - 4080'
Topographic Setting: Low benches covered by basalt and chert cobbles and alkalai flats around a series of seep springs.
Vegetation: Sparse vegetation over entire area, primarily greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* spp.), and saltgrass (*Distichlis stricta*). Rushes and sedges directly adjacent springs.
Disturbance: Some jeep trails and motorcycle tracks in the area.
Cultural Resources: One large, diffuse prehistoric quarry/workshop site, 26Ch584, was recorded.

SB-6. USGS Quad: Soda Lake 15' (Map IIIi)
Location: T.19N., R.27E., E½ of SW¼, SW¼ of SE¼ Sec. 9; E½ of NW¼, W½ of NE¼, NE¼ of SW¼, NW¼ of SE¼, Sec. 16.
Area: 1 mile NS/.5 mile EW (320 acres)
Elevation: 4010' - 4050'
Topographic Setting: Low deflated dunes and alkalai flats adjacent marsh. Large historic dunes rise sharply 40 feet above the marsh area in the northwestern corner of the sampling unit.
Vegetation: Greasewood (Sarcobatus vermiculatus) is the dominant vegetation on the deflated dunes and pans, with sporadic occurrences of saltbush (Atriplex spp.), saltgrass (Distichlis stricta), Russian thistle, and unidentified flowering forbs.
Disturbance: Historic and recent glass fragments and tin cans in the pans and dunes. Cattle grazing over entire area.
Cultural Resources: One large prehistoric site, 26Ch583, was recorded in the low dunes adjacent the marsh. A previously recorded site, Ch477 is located 0.25 mile south of sample unit.

Historic Background

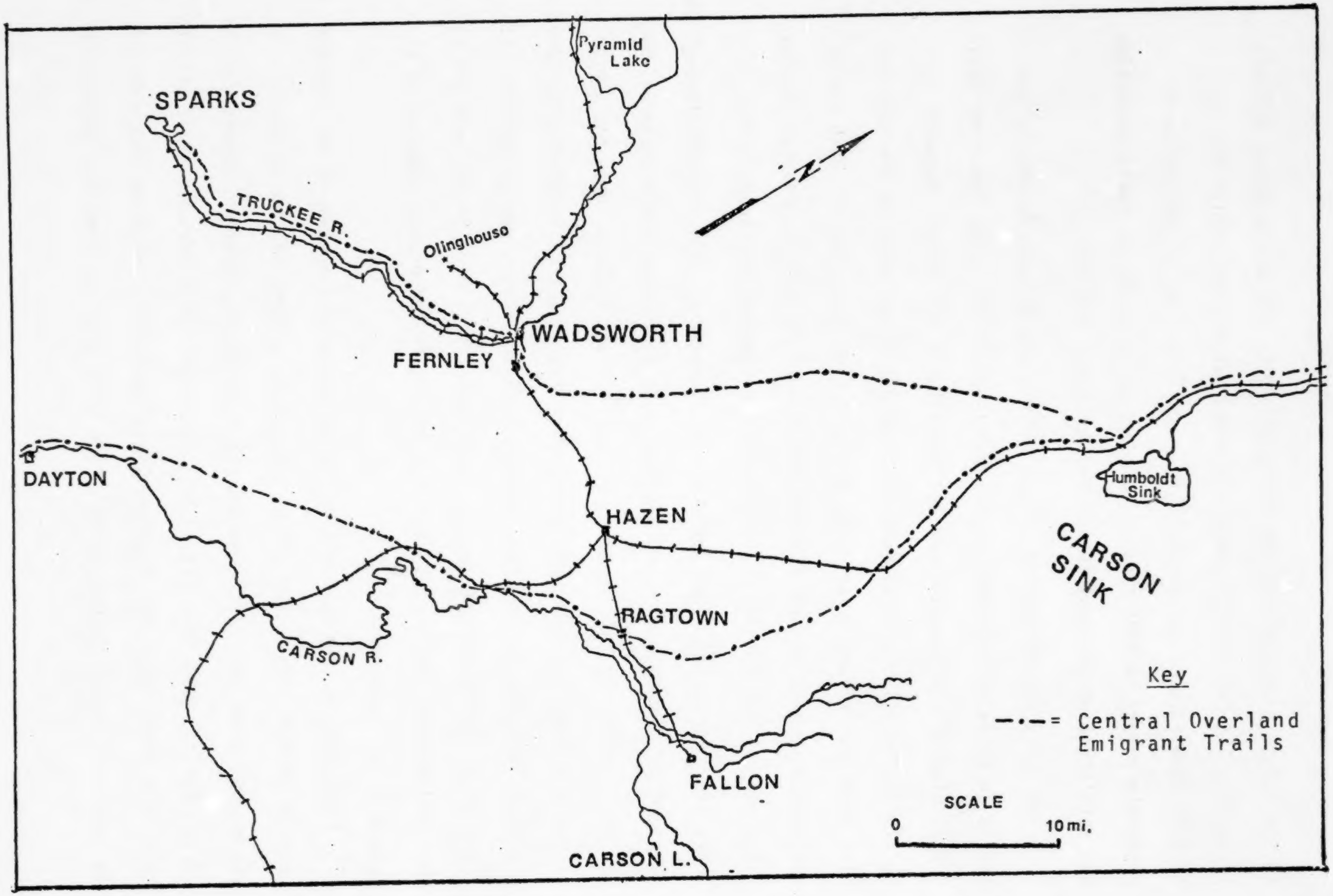
The Truckee Meadows and Lahontan Basin history reflects the earliest exploration and settlement of the western Great Basin. Fur traders and explorers blazed trails along the Carson and Truckee rivers, laying out the routes that thousands of settlers and prospectors would follow to the "Golden Lands" of California. The first explorers of the Humboldt River were members of the British Hudson's Bay Company under the leadership of Peter Skene Ogden. In May, 1829, Ogden's company reached the Humboldt River near present-day Winnemucca and followed the river to its sink (Elliott 1973: 37). While camping at Humboldt Sink, they met a group of Indians who told them about the Truckee River. At that time, Ogden thought that the Truckee River must flow into the sea. He did not continue his westward explorations but returned along the Humboldt and then north and west to the Quinn River. Later in the year, Ogden's company set out on their sixth Snake River Expedition (1829-1830). On this expedition, they again followed the Humboldt River to its sink, then continued westward into California, crossing from the Humboldt Sink to the Carson River and Carson Sink on to Walker Lake.

This journey from the Humboldt Sink to the Carson River represents the earliest known European crossing of the area which later became the Carson River Route of the Overland Trail (Elliott 1973:38; Mordy and McCaughey 1968:222) (Map II).

Ogden's expedition was closely followed by a group of American fur trappers under the leadership of Joseph Walker. In 1833, Walker's party followed a route along the Humboldt similar to that of Ogden's. The Walker Expedition also met a group of Indian near the Humboldt Sink; however, the encounter led to an unfortunate incident. A number of men were angered by the theft of some of their traps by the Indians and a series of skirmishes ensued. This led to the first significant conflict between Whites and Indians in the Great Basin. On October 5, 1833, Walker's company attacked a group of Paiutes and killed thirty or more Indians. This battle "...laid the groundwork for later Indian animosity towards Walker in particular and Whites in general" (Elliott 1973:39).

"The climax in the explorations of the Great Basin came with the expeditions of John C. Fremont in the years between 1843 and 1853" (Elliott 1973:43). Moved by the concept of Manifest Destiny, Fremont set out, with Kit Carson as his guide, to map the unknown regions of the West for future inclusion in the territory of the United States. Fremont's expeditions also laid the groundwork for another emigrant route between the Humboldt Sink and the Sierran passes, the Truckee River Route.

On his second expedition (1833-1844), Fremont took a southwesterly route from Fort Vancouver into northwestern Nevada. On January 10, 1844, he discovered a large lake, Pyramid Lake, which he named after the distinctive rock formation near the eastern shore. From Pyramid Lake, he followed the Truckee River to the big bend at present-day Wadsworth. From Wadsworth, he crossed


SPARKS
Pyramid Lake
TRUCKEE R.
Olinghouse
WADSWORTH
FERNLEY
DAYTON
HAZEN
RAGTOWN
CARSON R.
FALLON
CARSON L.
Humboldt Sink
CARSON SINK
N
Key
—·—= Central Overland Emigrant Trails
SCALE
0
10 mi.

Map II; Historic Trails and Railroads

to the Carson River, via Carson Sink, and on to the Walker River (Elliott 1973:43). The result of Fremont's journey was to make public the first systematic knowledge of the Great Basin. The Government's publication of Fremont's report in 1845 provided a great stimulus to the early emigration and settlement of the West (Mordy and McCaughey 1968:201).

The early expeditions of Ogden, Walker, and Fremont delineated the trails to be later followed by streams of emigrants across the Great Basin. The section of the Central Overland Trail (also called the Humboldt or California Trail) which followed the Humboldt River split at the Humboldt Sink into the Truckee River Route or the Carson River Route. Both routes required emigrants to pass through the dreaded Forty Mile Desert, a barren wasteland between the Humboldt Sink and the Truckee and Carson rivers. There was no drinking water nor grass for livestock. The trudging through the heat, across the soft sand and alkalai flats was a long and treacherous haul, and it took a heavy toll in terms of both men and beasts. When the sorry caravans reached the sites of Wadsworth or Ragtown, the livestock were often so crazed with thirst that they plunged into the river, wagons and all. Evidence of the perils of the journey were well represented in the many graves, once marked with wagon wheels and log chains, in the pioneer cemeteries at Wadsworth and Ragtown.

From Ragtown, the Carson River Route followed the river to the present sites of Dayton, Empire and Carson City, only a short section of which is in the project area (Map II). The Truckee River Route, however, directly paralles the project area (Map II). Sections of the trail ruts are still visible at various spots along the Truckee, though most of it has been obscurred by the construction of Highway 80 (Emigrant Trail Marking Committee 1978:11-13).

At the point where the narrow canyon feeds into the Truckee Meadows, the structural remain of the earliest emigrant station can still be seen (page 26). The station was built as a trading post by a Mormon named Jamison in 1852 and served the emigrants as they came into the Truckee Meadows before the last haul over the Sierras (Thompson and West 1881:623).

The emigrant trails also served as the roadbeds for the first railroads across Nevada (Map II). The Central Pacific Railroad, forming part of the first transcontinental rail linkage across the United States, was built through Nevada in 1867. The line was constructed over Donner Pass, down the Truckee River to the Big Bend at Wadsworth, and from there across to the Humboldt River (Map II). Thus, it followed the same route as the Truckee River Route of the Central Overland Trail (Myrick 1962:3-19; Mordy and McCaughey 1968:239).

The Central Pacific Railroad, which later became the Southern Pacific, continued to build extensions and branches in Nevada for many years. Many of these extensions were built to service the developing lumber and mining industries. For example, the Fernley and Lassen Railway which ran from Fernley, across Dodge Flat and along the edge of Pyramid Lake to Susanville, was built between 1912-1913 to serve the Red River Lumber Company (Myrick 1962:41). The line is no longer in operation and the tracks have since been removed, however the original roadbed is still visible (Map II).

The mining boom in the Pah Rah Range west of Wadsworth stimulated the development of the Nevada Railroad Company in 1906. A standard guage railroad was constructed which ran between Wadsworth and the mining camp of Olinghouse (Map II). Though the project was heavily promoted in the Reno area and financially backed by a Reno Banker, Richard Kirman, who later became mayor and eventually governor of Nevada, it operated for little more

than a year. The failure of Nevada Consolidated Mine to produce the expected high yield resulted in the foreclosure of the mortgage on the railroad and its sale at auction in 1908. In 1909, the rails were torn up and "by 1911 there was not a single tie or rail to point out the location of the former railroad, although a sharp eye can still see traces of most of the old grade" (Myrick 1962:56).

The towns of Wadsworth, Fernley, and Hazen were initially established to service the growing needs of the expanding railroad system. When the railroads declined after 1930, so did the towns build up around them. When the Southern Pacific Railroad moved its division headquarters from Wadsworth to Sparks in 1905, the town of Wadsworth diminished in size and importance. The town of Hazen, which once had a round house and depot, and several saloons, was nearly completely razed in the fire of 1908. The community of Fernley, however, whose growth was also related to the expansion of the railroad system, continued to thrive as the center of a busy farming district, a direct consequence of the building of the historic Truckee-Carson Canal.

An interest in the possibilities of land reclamation through the diversion of the Truckee River began in the late 1880's. In 1889-1890, Major J.W. Powell ordered a systematic investigation of the Truckee River flow. Francis G. Newlands, the sole representative of Nevada elected to Congress in 1892, continued to push for a federally-funded reclamation project in the Lahontan and Carson valleys. Members of Congress, however, had very mixed feelings about the utility of any land reclamation projects in the West, and the proposed Truckee River diversion project was shelved for a time. Then, in June 1902, President Theodore Roosevelt passed the Newlands Reclamation Act. As a consequence, the Truckee-Carson Irrigation Canal became the first federally-backed land reclamation in the western United States. By 1905, Derby Dam and the Truckee Canal were constructed to divert water from the Truckee into the Carson River. These actions represented only the first of a series of water diversion projects, leading to the agricultural development of the Lahontan and Carson Valleys (Mordy and McCaughey 1968:12).

Derby Dam is listed on the National Register of Historic Places, a tribute to its importance in the agricultural development of the State of Nevada and as the first federal land reclamation project in the West.

Specific historic sites located in the project area which reflect early exploration, emigrant trails, railroad towns, and the Truckee-Carson Irrigation project are provided below.

Historic Sites

Three historic sites were recorded in the course of the field survey; 26Wa2677, 26Wa2682, and 26St31. An additional eight sites of historic interest are located within or directly adjacent to the project area. These sites have been given arbitrary numbers and are plotted on Maps IIIa through IIIj in Appendix A. Mordy and McCaughey (1968) reference and page numbers are also assigned whenever applicable, i.e., MM#27, p.117. A description of both newly recorded sites and documented historical places are listed by county below. Sites listed on or with potential for inclusion in the National Register of Historic Places are so indicated.

Description of Historic Sites

Washoe County

Site Number: 26Wa2677 (newly recorded)
USGS Quad: Wadsworth 15'
Map Reference Number: IIId
Project Area: Truckee Pipeline
Description: Historic dump adjacent railroad tracks near Derby Dam. Artifacts include broken historic bottle glass, ceramic fragments, tin cans,

and miscellaneous metal fragments. The dump is severely disturbed and though only fragmented materials remain, it appears to date from around, or just before, the turn of the century. It was probably related either to the construction of the Central Pacific Railroad in 1868 (Myrich 1962:(1)13 or the construction of the Truckee Canal in 1905 and the camp at Derby (Mordy and McCaughey 1968:12).
National Register Potential: No

Site Number: 26Wa2682 (newly recorded)
USGS Quad: Wadsworth 15'
Map Reference Number: IIIf
Project Area: Dodge Flat
Description: Historic semi-subterranean log structure, probably associated with early ranching activities along the Truckee River. Inside walls and roof (since collapsed) are covered with corrugated sheet iron, attached with round nails. Two old square nails in the roof probably indicate an earlier date of construction (pre-1920) with subsequent modifications. Recently, the structure has been used as a cattle shed.
National Register Potential: No

Site Number: #1, Jamison's Station (MM, p.198)
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIa
Project Area: Truckee Pipeline
Description: Jamison's Station was one of the first settlements in the Truckee Meadows. A Mormon emigrant from the Carson Valley named Jamison built the station in 1852 (Mordy and McCaughey 1968:198). He traded with emigrants coming down the Truckee River Route of the Overland Trail, buying their lean and exhausted stock or trading good cattle for them (Thompson and West 1881:623). The stone ruins are still visible at the edge of the river near the Sewage Treatment Plant, one mile south of present-day Vista.
National Register Potential: Yes

Site Number: #2, Mustang Flat
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIc
Project Area: Truckee Pipeline
Description: Emigrant trail and camp area. Mustang Flat represents one of the known emigrant camping areas along the Truckee River. Faint traces of the old wagon road are still visible in certain places. The Central Pacific Railroad roadbed, abandoned in 1905, is also extant.
National Register Potential: Yes, as part of the Truckee River Route of the Overland Emigrant Trail.

Site Number: #4, Derby Dam (MM26, p.12)
USGS Quad: Wadsworth 15'
Map Reference Number: IIId
Project Area: Truckee Pipeline
Description: The construction of Derby Dam as a diversion dam on the Truckee River represented the first stage in the Truckee-Carson Irrigation Project (Newlands Project). The dam, which was in operation by 1905,

(Site No. 4 - cont.)

diverted water from the Truckee River through the Truckee Canal to the Carson River (Mordy and McCaughey 1968:12). According to Glass and Glass (1975:44), a tough little town grew up at Derby. "'A man for breakfast every morning' became the gruesome slogan of the construction camp. Bodies were frequently found in the river or along the big ditch leading to the Carson Valley after a night's carousing." The camp faded away with the completion of the canal construction.

National Register Potential: Derby Dam has been included in the National Register of Historic Places, entered April 26, 1978.

Site Number: #5, Wadsworth (MM45, p.201)
USGS Quad: Wadsworth 15'
Map Reference Number: IIIf
Project Area: Dodge Flat
Description: On Captain John C. Fremont's first expedition to Nevada in 1844, he followed the Truckee River from Pyramid Lake to the present site of Wadsworth. He was the first European to camp there (Mordy and McCaughey 1968:201).

Wadsworth represented one of the many camp spots along the Truckee River route of the Emigrant Overland Trail. Here the emigrants rested themselves and their stock and buried their dead before proceeding on along the Truckee River. "Many livestock were so crazed with thirst on reaching the river, that they plunged headlong into the water, sometimes upsetting the wagons" (Nevada Emigrant Trail Marking Committee 1978:11). A pioneer cemetery, in a bad state of decay, marks the camp spot.

The town of Wadsworth was established in 1868 as a division headquarters of the Central Pacific Railroad. In 1905, the headquarters were moved to Sparks, and the town has since declined (Mordy and McCaughey 1968:201).

National Register Potential: Yes

Storey County

Site Number: 26St31 (newly recorded)
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIb
Project Area: High Basin Site
Description: Enigmatic historic stone structure. It consists of a roughly rectangular dry-laid masonry structure seven feet long by five feet wide and two feet high. The function or time of construction has not been established, but may be related to sheep raising or mining activities. It does not appear to have been used for human habitation since no artifacts were found in association with it.

National Register Potential: No

Site Number: #3, Clark Station
USGS Quad: Wadsworth 15'
Map Reference Number: IIId
Project Area: Truckee Pipeline

(Site No. 3 - cont.)

Description: The river floodplain near present-day Clark Station was called "Little Meadows Campground" by the early emigrants. It marks a rest area on the Truckee River Route of the Emigrant Overland Trail. The abondoned railroad bed of the Central Pacific Railroad, realigned between 1902 and 1905, is also visible here (Nevada Emigrant Trail Marking Committee 1978:12).
National Register Potential: Yes

Lyon County

Site Number: #6, Fernley
USGS Quad: Wadsworth 15', Two Tips 15'
Map Reference Number: IIIe, IIIg
Project Area: Fernley-Swingle Bench
Description: With the development of the Truckee-Carson Irrigation Project (Newlands Project) in the early 1900's, the town of Fernley grew up as a busy farming community (Glass and Glass 1975:45). Fernley also represented a terminous of the Southern Pacific Railroad which ran along the western shores of Pyramid Lake and thence to lumber camps in the Sierra Nevada Range (Nevada Writers Project 1940:139). The tracks across Dodge Flat and along Pyramid Lake have since been removed, though the roadbed is still visible.
National Register Potential: No

Churchill County

Site Number: #7, Hazen
USGS Quad: Two Tips 15'
Map Reference Number: IIIh
Project Area: Fernley-Swingle Bench
Description: The town of Hazen grew up as a result of the expansion of the railroad. It was established as a Southern Pacific Railroad stop in 1902. By 1904, it had a post office and several saloons to serve the workers on the Truckee Canal. Its importance grew when it became a northern terminus on completion of the Hazen cutoff with the line to Fort Churchill. In 1906, Hazen became a four-way junction with the construction of a line to Fallon. A depot and round house were constructed, escaping the fire of 1908 which wiped out the rest of the town. later became a trading center with a school servicing the nearby ranches. It declined after 1930 as the railroads became a less important form of transport (Paher 1970:90; Nevada Writers Project 1940:217).
National Register Potential: Yes

Site Number: #8, Ragtown (MM33, p.15-16)
USGS Quad: Soda Lake 15'
Map Reference Number: IIIi
Description: The Ragtown site was an important station on the Emigrant Overland Trail since it represented the first water stop after crossing the Forty Mile Desert from the Humboldt. Several explanations for the odd

(Site No. 8 - cont.)

name of the town are given. One explanation states that the emigrants, after the long haul across the desert, divested themselves of their tattered clothing to jump into the Carson River. "Long, scattered piles of rags daily adorned the banks of that stream" (Thompson and West 1881 (1):365). Another version states that the site was composed of cloth houses built by traders from California to take advantage of the emigrant traffic. When the traders left in the fall, "they left their ragged shelters to flutter in the wind" (Thompson and West 1881(1):365). The Nevada Writers Project (1940:267) gives a slightly different account. Early diaries indicate that the site was so named because of the litter of clothes, mattresses, and other household goods discarded as travelers lightened their loads before the long pull over the Sierras. Furthermore, Ragtown was supposed to have a suburb named Feathertown; "... someone had thrown away a goose-feather mattress that was later ripped open."

There was once an emigrant cemetery at Ragtown. It contained over 200 graves, variously marked with log chains and wagon tires, the results of cholera, fever, and exhaustion. The graveyard was obliterated by the flood of 1861-62 and subsequently destroyed by the construction of Highway 50/95 through it (Mordy and McCaughey 1968:15-16).

National Register Potential: Yes

Ethnographic Territories

At the time of the earliest White entry into the Carson-Reno area in the early 1800's, two linguistically and culturally distinct Indian groups occupied the project area, the Washo and the Northern Paiute (d'Azevedo 1963:4). The Washo constitute a linguistically anomalous group in the Great Basin; they are the only speakers affiliated with the larger Hokan linguistic stock, best represented on the central coast and in northeastern California (Downs 1966: 7). The western Hokan languages are not closely related, however, suggesting that the separation into distinct languages occurred several thousand years ago (Kroeber 1955; Price 1963). The Northern Paiute language, on the other hand, is a member of the Shoshonean branch of the Uto-Aztecan linguistic stock, widely distributed in the Great Basin (Stewart 1941; Steward 1938).

Washoe territory centered around Lake Tahoe and included Washoe Lake and the Truckee Meadows; however, a large peripheral area, shared with adjacent groups, was intermittently used for hunting and gathering activities (Downs 1966:5; d'Azevedo 1966:323). This peripheral zone extended from Honey Lake in the north to Walker and Mono lakes in the south and to the Pah Rah and Virginia Ranges in the east. The area to the east of the Washoe was occupied by the Northern Paiute. There were at least three major Paiute groups in the project area. One area centered at the Humboldt Sink, another at the Carson Sink, and one in the Truckee River-Pyramid Lake area (Steward 1974:87, 102). Ethnographers do not agree on the number of separate bands occupying these areas. The data on named local groups are conflicting, and the determination of these bands is aggravated by the fact that the wide-ranging subsistence pursuits of the Northern Paiute precluded rigid territorial localization (Steward 1974:116). "On the whole, there was great fluidity of population; .... The Indians freely crossed from one local territory to another in quest of foods in accordance with the season" (Steward 1974:108).

Prehistoric Background

Previous archaeological investigations in the Truckee Meadows and Humboldt-Carson Sinks indicate that there were a series of distinct prehistoric cultural adaptations in the vicinity of the project area. Though Carter (1958) has argued that ancient man may have been in the Reno area as early as 20,000 years ago, there is no firm evidence for this hypothesis. The earliest prehistoric sites apparently date between 11,000 B.P. and 8000 B.P. (Hester 1973:61). These open occupation sites are often located on ancient lake terraces and are characterized by early projectile point styles (Clovis, Folsom, Lake Mojave), crescents, and large bifacial tools. These early cultural manifestation have been variously assigned to the Lake Mojave

Complex (Campbell et al. 1937), San Diequito Complex (Warren 1967), Fluted Point Tradition (Tuohy 1965, 1967, 1968a, 1968b; Davis and Shutter 1969; Clewlow 1968a; Campbell and Campbell 1940), Western Lithic Co-Tradition (Davis 1967; Davis, Brott and Weide 1969), Hascomat Complex (Warren and Ranere 1968), and Fallon Phase (Grosscup 1956).

Researchers are not in agreement on the economic adaptations represented by these various archaeological complexes. Several distinct resource bases are postulated and include primary dependence on either big game hunting, lake-side resources, or generalized seed gathering (Tuohy 1968b; Meighan 1969; Shutter 1968; Davis 1966; Warren 1967; Rozaire 1963; Heizer 1966; Heizer and Baumhoff 1970; Hester 1973). It is not clear, however, whether these complexes represent distinct cultural and temporal manifestations of early man in the Great Basin, or whether they are variants of a single cultural tradition. The sites are not firmly dated; hence temporal and cultural relationships are difficult to establish. Associated megafaunal remains which could support a Big Game Hunting tradition in the Great Basin are also lacking, as is good evidence for an early widespread desert-oriented, generalized seed-gathering lifeway like that represented in the basal levels of Danger Cave (Jennings 1957).

According to Hester (1973), the early man sites located in the vicinity of the project area, especially the Fallon Phase sites (Hathaway Beach, Dansie, Harvey, Sadmat) in the Carson Sink (Grosscup 1956; Warren and Ranere 1968; Tuohy 1968b), and scattered surface finds of fluted points in the Reno area and Carson-Humboldt sinks (Tuohy 1968b; Davis and Shutter 1969) are representative of an early lacustrine-oriented occupation of the area, dating from between ca. 11,000 B.P. to about 8000 B.P. He proposed that these early complexes be included under one tradition, the Western Pluvial Lakes Tradition, as defined by Bedwell (1970:231). These early sites are usually found along post-Pleistocene lake shores and share many of the same traits, i.e., large fluted (Clovis) or stemmed (Lake Mojave) projectile points, crescents, and heavy bifacial tools. Though a separate fluted point tradition (Big Game Hunting) may have preceded or coexisted with it, there is insufficient evidence "for more than speculation" (Hester 1973:68).

Further investigations in the Humboldt Sink and Carson Sink areas indicate that the Western Pluvial Lakes Tradition (or traditions) were replaced by what has been designated by Heizer (1956:51) as the Humboldt Culture, dated at ca. 8000-7000 B.P. Several rockshelters and numerous open sites have been excavated in the Humboldt Sink, the most famous of which are Lovelock Cave, Humboldt Cave, and Leonard Rockshelter. The assemblages of these caves have provided the cultural chronologies on which interpretations of the prehistory of the Lahontan Basin are based. The earliest dates and most complete stratigraphic-chronological sequence have been derived from Leonard Rockshelter. A radiocarbon date of 7038 ± 350 B.P. was obtained on 3 atlatl darts from the lowest level of the cave (Heizer 1956:51). Other materials included within the Humboldt Culture strata were wooden and fiber artifacts, beads, fragments of netting, and two obsidian flakes. The next stratigraphic level, which included an infant burial and twined basketry, was dated at 5694 ± 325 radiocarbon years ago. Though no other artifacts were associated with the burial, it has been designated as the Leonard Culture and is equated with a dry climatic period based on the deposition of wind blown sediments assumed to have been derived from deflation of the Humboldt Lake bed. The uppermost level of the cave is correlated with assemblages from Lovelock and Humboldt Caves, dating from between ca. 2000 B.C. and 1900 A.D., and designated as the Lovelock culture (Heizer 1956:51). Correlations between the upper levels of Humboldt

Cave and Lovelock Cave are based on radiocarbon dates taken many years after the original excavations of Lovelock Cave; hence their associations are somewhat uncertain.

Lovelock Cave was first excavated by Loud in 1912, and then Loud and Harrington in 1924, prior to the development of radiocarbon dating methods. At the time of their investigations, the site had already been seriously disturbed by guano mining and pot hunting. A control pit was dug in one corner of the cave which yielded three stratigraphic-cultural periods which were termed Early, Transitional, and Late (Loud and Harrington 1929:24). A large number of perishable artifacts were recovered from the cave which provide the basis for correlation with assemblages elsewhere. Several attempts have been made to precisely date the stratigraphic-cultural levels (Early, Tansitional, Late) outlined by Harrington. Cressman obtained one date of 3172 ± 260 radiocarbon years from the bottom of Harrington's trench (Heizer 1966:51). Heizer and Napton (1970:Table 4) report a number of other radiocarbon dates. The lowest levels are dated at 4520 ± 110 B.P. and 4690 ± 110 B.P., the middle levels at 3980 ± 20 B.P. and 4720 ± 110 B.P., and the upper levels at 2610 ± 120 B.P. The most intensive use of the site occurred between 3400 and 1500 years at which time a massive rockslide blocked off part of the cave portal. Heizer and Napton (1970:40) postulate that, "the fluctuations of human occupation of the cave and lakeside sites probably coincided with the oscillations of Humboldt Lake." The interior cave was used only infrequently between 700 A.D. and its abandonment in historic times.

The Humboldt Lakebed site, on the shores of Humboldt Lake below Lovelock Cave, has been investigated by Cowan and Clewlow (1968). They indicate that the site may have been occupied as early as 4000 years ago (Cowan and Clewlow 1968:211). Projectile points from the site, including Humboldt, Pinto, Elko, Eastgate, Rose Spring, Cottonwood, Desert Side-Notch, Martis, and Gypsum types (Heizer and Clewlow 1968), may indicate a long cultural sequence. The two radiocarbon dates from the site, 2690 ± 250 B.P. and 550 ± 60 B.P. (Clewlow et al. 1970) are disputed (Heizer and Napton 1970:40).

Another famous cave site in the Humboldt Sink area is Humboldt Cave (Heizer and Krieger 1956). Large amounts of basketry and other perishable materials were recovered during excavation. Comparison with the Lovelock Cave assemblage have been interpreted as indicating Transitional or Late Lovelock affiliations; however, the earliest radiocarbon taken from a cache is 1953 ± 175 B.P. (Heizer 1956:51). There is a problem with correlation since certain artifact types "... which are Early and Transitional in Lovelock Cave (such as L-shaped scapula awls and horn sickles) occur in the uppermost levels of Humboldt Cave" (Heizer 1956:51). There are many correspondences between the assemblages in the upper levels of Humboldt and Lovelock Caves with the ethnographic Paiute, yet there are also important differences (Heizer and Krieger 1956:87). The recency or antiquity of the Northern Paiute, hence, remains an open-ended question (Heizer 1956:53).

A number of sites in the Grimes Point area of the Carson Sink have also been investigated. These sites include numerous caves, petroglyphs, burials, and open occupation sites, the earliest of which are the "Fallon Phase" sites (Grosscup 1956). The chronological sequence of cultural development in the Carson Sink area after 8000 B.P. is drawn from excavations at Hidden Cave (Roust and Grosscup 1957; Grosscup 1956). The sequence, though as yet poorly dated, has been broken down into the following phases:

Hidden Phase (6500-7000 B.P.): Lowest level at Hidden Cave, defined on the basis of Humboldt Concave Base A projectile points.

Carson Phase (6500-5000 B.P.): Next stratigraphic level, defined on the basis of Pinto points and assigned to the mid Post-Glacial on the the basis of laminated aeolian silts.

Lovelock Phase (4700-1500 B.P.): Upper levels of the cave, defined on the basis of perishable material and associated Pinto, Elko, and Gypsum projectile points.

A final late phase, the Dunes Springs Phase, which has been linked to the historic Northern Paiute, has been defined from open occupation sites with Desert Side-Notched projectile points around surviving water sources (Grosscup 1956:62). Further investigations of Hidden Cave by David H. Thomas may clarify the prehistoric cultural chronology in the Carson Sink and its relationship to the Humboldt Sink phases described by Grosscup (1956), and Roust and Grosscup (1957), as well as relationships to other poorly dated Caves (Napton 1971; Tuohy 1969) and open occupation sites in the Lahontan Basin (Morrison 1964).

Archaeological investigations in the ethnographic Washoe territory around Reno are usually interpreted in relation to sequences initially defined for the East-Central Sierra Nevada (Heizer and Elsasser 1953). Two complexes, Martis and Kings Beach, are defined. The earlier Martis Complex was first marked by a basalt-working industry, characterized by large heavy points with a large variety of form, ususally located with reference to good hunting and gathering locales. The Kings Beach sites reflect a strong orientation to fishing, and are characterized by light obsidian and flint tools, and Desert Side-Notched projectile points.

Based on later excavations at Spooner Lake and Daphne Creek, Elston (1971: 135-140) divided the Martis Complex into two phases. Phase I (3000-2000 B.P.) is interpreted to mark the first intensive occupation of the Sierras and is characterized by Elko, Martis, and Sierra Stemmed triangular projectile points. Phase II (2000-1500 B.P.) is marked by the introduction of the bedrock mortar and bow and arrow. Projectile points include a continuation of Sierra

Stemmed triangular, with Rosesprings and Eastgate types. The Kings Beach complex is dated from 500 A.D. to the ethnographic present, tentatively tying the Kings Beach complex to the ethnographic Washoe (Elston 1971:140). Elston also proposed an "extremely hypothetical" Spooner Complex, dating between ca. 7000-5000 B.P. to about 3000 B.P. on the basis of two Humboldt Concave Base and one Pinto projectile points and "the inferred use of the mano and metate" (Elston 1971:135). Several other Martis and Kings Beach Sites have been reported in the project area (Matley and Turner 1967; Hagerty 1969; Elston and Turner, n.d.; Elston and Davis 1972), but firm radiocarbon dates are generally absent and assemblages often reflect mixed Kings Beach-Martis components. Materials excavated at the Towne sites in the Steamboat Springs locality (Elston and Davis 1972:13) contained both Martis and Kings Beach components; however, they occurred in mixed deposits. The nearby Thompson site also contained a Kings Beach component. The Kings Beach component here was underlain by lanceolate projectile points associated with a housepit, cache, and earth oven postulated as "The Steamboat Component" (Elston and Davis 1972:12). The relationship of the Steamboat component to the Martis Complex is rather unclear, since according to Elston and Davis (1972:11), the difference is that in the Steamboat Component, "... there is only one type of point, whereas in a 'typical' Martis assemblage, there are five or more." In short, much of the work relating to the proposed Martis-Kings Beach chronology in the Reno and Central Sierras area is as yet poorly understood. Further controlled excavations will need to be conducted before the chronology of the Reno area can be established. Unfortunately, one of the most potentially valuable research areas, the Truckee Meadows, "an area with one of the highest aboriginal densities in the Great Basin," is rapidly being destoryed by urban development (Elston and Davis 1972:13).

Prehistoric Sites

A total of thirteen prehistoric sites were recorded in the course of the survey. An additional fifteen prehistoric sites have been previously recorded within or directly adjacent to the project area. All sites have been plotted on maps based on U.S.G.S. 15 minute quads, designated IIIa through IIIj, and included as Appendix A. A short description of both newly and previously recorded sites listed by county is provided below. Each site description includes the following information:

1) Site Number;
2) U.S.G.S. quad reference;
3) Map Reference Number, i.e., a key to maps provided in Appendix A, designated IIIa through IIIj;
4) Project Area, i.e., Truckee Pipeline, High Basin Pipeline, High Basin Site, Dodge Flat, or Fernley-Swingle Bench;
5) Description, i.e., a brief description of site type, associated artifacts, and indications of collected materials; and,
6) National Register Potential, i.e., designation of those sites which have been evaluated as having potential for inclusion in the National Register of Historic Places.

Description of Prehistoric Sites

Washoe County

Site Number: 26Wa2 (previously recorded; also listed as 26Wa35 and 26Wa43)
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIa
Project Area: Truckee Pipeline
Description: Court of Antiquity Petroglyphs site with associated lithic debris and mussel shells on rhyolite terrace at the edge of Truckee River. Heizer and Baumhoff (1962:63-64) indicate that the petrophyphs are "...admirably placed for a game ambush site."
National Register Potential: Yes

Site Number: 26Wa1498 (previoulsy recorded)
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIa
Project Area: Truckee Pipeline
Description: Small material workshop site including both retouched and unmodified flakes located on an alluvial slope at the base of a steep runoff area between two ridges. Site has been collected.
National Register Potential: No

Site Number: 26Wa1601 (previously recorded)
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIc
Project Area: Truckee Pipeline
Description: Petroglyphs associated with basalt and chalcedony flakes on bench 30 feet above the Truckee River.
National Register Potential: Yes

Site Number: 26Wa2131 (previously recorded)
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIc
Project Area: Truckee Pipeline
Description: Petroglyph site on basaltic cliff face in Truckee River Valley
National Register Potential: Yes

Site Number: 26Wa2469 (previously recorded)
USGS Quad: Wadsworth 15'
Map Reference Number: IIIf
Project Area: Dodge Flat
Description: Small open site in disturbed area north of Pyramid St. in Wadsworth. Artifacts include one obsidian core fragment and one obsidian flake. Site has been collected.
National Register Potential: No

Site Number: 26Wa2678
USGS Quad: Wadsworth 15'
Map Reference Number: IIIf
Project Area: Dodge Flat
Description: Small temporary campsite in dunes along edges of a small dry lake in Dodge Flat. Groundstone and secondary and tertiary reduction flakes of basalt, chert and obsidian. Numerous retouched and apparently utilized flakes. Two Rosesprings corner-notched points collected.
National Register Potential: Yes

Site Number: 26Wa2679
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIa, IIIc
Project Area: Truckee Pipeline
Description: Small material workshop site on the north slope of a basalt cobble-covered knoll. Materials observed include: unmodified chert and basalt flakes, one core, and shatter. Nothing collected.
National Register Potential: No

Site Number: 26Wa2680
USGS Quad: Wadsworth 15'
Map Reference Number: IIIf
Project Area: Dodge Flat
Description: Small material workshop site on the floodplain of the Truckee River. Assemblage consists primarily of unmodified thinning flakes of chert. Only one retouched flake noted. Severe erosion and human disturbance in area. Nothing collected.
National Register Potential: No

Site Number: 26Wa2681
USGS Quad: Wadsworth 15'
Map Reference Number: IIIf
Project Area: Dodge Flat
Description: Temporary campsite on tops of Truckee River terraces. At least two distinct kinds of assemblages noted: (1) large basalt flake and core tools, many bifacially retouched; and, (2) small, mostly unretouched but probably utilized chert thinning flakes. Many of the materials have been severely sand-blasted. Nothing collected.
National Register Potential: Yes.

Storey County

Site Number: 26St5 (previously recorded)
USGS Quad: Spanish Springs Valley 15'
Map Reference Number: IIIc
Project Area: Truckee Pipeline
Description: Unknown. Site record form was unavailable at Nevada State Museum at time of inquiry.
National Register Potential: unknown.

Site Number: 26St25
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIb
Project Area: High Basin Pipeline
Description: Quarry/workshop site on the top and down northeast slopes of ridge. Very thin scatter of unmodified chert flakes, shatter, and a few cores. Nothing collected.
National Register Potential: No.

Site Number: 26St26
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIb
Project Area: High Basin Pipeline
Description: Temporary campsite and quarry/workshop site in dunes in saddle. Materials include cores, unmodified and modified chert flakes, shatter, naturally-occurring chert nodules, bifacial choppers, several rock features (hearths ?), and groundstone. One small Rosesprings corner-notched point was collected.
National Register Potential: Yes

Site Number: 26St27
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIc
Project Area: Truckee Pipeline
Description: Temporary Campsite, material workshop site on terrace at southeast edge of the Truckee River. Assemblage includes both unmodified and modified flakes of basalt, a wide variety of cherts, and some obsidian. Most of the chert and obsidian flakes are small (1-2cm) tertiary flakes and have been imported into the area. The basalt materials are larger, include some primary decortication flakes, cores, and many secondary flakes, suggesting that the basalt is from a local source. Nothing collected.
National Register Potential: Yes

Site Number: 26St28
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIb
Project Area: High Basin Site
Description: Temporary campsite and quarry/workshop site in low dunes on top and south slopes of a low rise adjacent wide wash. Natural nodules of white mottled and yellow chalcedonous chert occur with basaltic cobbles and rocks over parts of the valley floor. Dense scatter of materials including cores, unretouched primary, secondary and tertiary flakes, many retouched flakes, and one tabular metate. One Rosesprings-Eastgate triangular corner-notched projectile point collected.
National Register Potential: Yes

Site Number: 26St29
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIb
Project Area: High Basin Site
Description: Quarry/workshop site on colluvial slopes of low knoll. A few retouched materials were noted but most are unmodified primary and secondary flakes, shatter, and cores of naturally occurring chert. Nothing collected.
National Register Potential: Yes

Site Number: 26St30
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number IIIb
Project Area: High Basin Site
Description: Quarry/material workshop site on top and slopes of low knoll. Light scatter of materials including shatter, unmodified primary and secondary reduction flakes and cores of local chert. Natural nodules of white mottled and yellow chalcedonous chert occur with basaltic cobbles and rocks over the top of the knoll, providing a good source of knappable materials. One Rosesprings side-notched projectile point collected.
National Register Potential: Yes

Site Number: 26St50 (previously recorded)
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIb
Project Area: High Basin Site
Description: Temporary campsite and quarry/workshop site in low dunes adjacent

small playa. Materials are scattered over entire valley. Artifacts include retouched and unretouched flakes of obsidian, chert, and local jasper, jasper cores, and metates. Some flakes collected.
National Register Potential: Yes

Site Number: 26St51 (previously recorded)
USGS Quad: Virginia City 15', Steamboat 7.5'
Map Reference Number: IIIb
Project Area: High Basin Site
Description: Quarry/workshop at the base of a knoll and in the bottom of a large, wide wash. Large, diffuse scatter of unmodified flakes, shatter, and a few cores. Nothing collected.
National Register Potential: Yes

Churchill County

Site Number: 26Ch62 (previously recorded)
USGS Quad: Two Tips 15'
Map Reference Number: IIIh
Project Area: Fernley-Swingly Bench
Description: Pusiatupogi, i.e., Louse Cave, a rockshelter at Black Butte north of Hazen, investigated by Loud and Harrington (1929).
National Register Potential: Yes

Site Number: 26Ch141 (previously recorded)
USGS Quad: Two Tips 15'
Map Reference Number: IIIh
Project Area: Fernley-Swingle Bench
Description: Small cave in dendritic tufa. Materials include a greasewood fragment of possible digging stick, flakes, and burnt bone. Site has been seriously vandalized.
National Register Potential: No

Site Number: 26Ch163 (previously recorded)
USGS Quad: Two Tips 15'
Map Reference Number: IIIh
Project Area: Fernley-Swingle Bench
Description: The Sadmat Site," an open surface, Paleo-Indian site located just above the 3990 foot beach line of the Lahonton Basin near Hazen. Though undated, the site is believed to represent a very early occupation of the Lahonton Basin, from between 5000 BP (Warren and Ranere 1968:9; Butler 1965) to as early as 7000 BP (Tuohy 1968:35). Site has been collected.
National Register Potential: Yes

Site Number: 26Ch477 (previously recorded)
USGS Quad: Soda Lake 15'
Map Reference Number: IIIi
Project Area: Fernley-Swingle Bench
Description: Small open site on terrace of Carson River. Artifacts include: 2 flakes, 1 biface, and 1 possible hammerstone. Site has been collected.
National Register Potential: No

Site Number: 26Ch478 (previously recorded)
USGS Quad: Fallon 15'
Map Reference Number: IIIj
Project Area: Fernley-Swingle Bench
Description: Extensive buried aboriginal base camp. Cultural material is eroding from a strata approximately 6 to 8 feet below the surface of a terrace projecting out onto Carson River floodplain. Materials include: numerous mano and metate fragments (basalt); jasper, chert, and obsidian flakes; bone; and awl fragment. Not collected.
National Register Potential: Yes

Site Number: 26Ch583
USGS Quad: Soda Lake 15'
Map Reference Number: IIIi
Project Area: Fernely-Swingle Bench
Description: Large temporary campsite area in deflated dunes and alkalai flats at eastern edge of Swingle Bench. Dense scatter of materials, most apparently unretouched thinning flakes of chert and obsidian. Utilization, however, is likely. 1 metate and 2 cobble manos (basalt) were also noted. Site has been seriously disturbed. Nothing collected.
National Register Potential: Yes

Site Number: 26Ch584
USGS Quad: Two Tips 15'
Map Reference Number: IIIh
Project Area: Fernley-Swingle Bench
Description: Large, diffuse quarry/workshop on low benches adjacent a series of natural seep springs. Nodules of natural chert, jasper, and basalt are scattered over the bench tops. Density of cultural materials is rather low but includes unretouched primary and secondary flakes, cores, a few thinning flakes and shatter. Very few retouched flakes noted. Nothing collected.
National Register Potential: Yes

Site Number: 26Ch585
USGS Quad: Two Tips 15'
Map Reference Number: IIIh
Project Area: Fernley-Swingle Bench
Description: Small material workshop site at the base of a tufa outcrop. Artifacts observed include 5 unmodified chert flakes. Nothing collected.
National Register Potential: No

Lyon County

Site Number: 26Ly22 (previously recorded)
USGS Quad: Wadsworth 15'
Map Reference Number: IIIe
Project Area: Truckee Pipeline
Description: Village site in consolidated dune sand on edge of bluff overlooking Truckee River. Wide variety of materials including manos, metates, hammerstones, core scrapers, projectile points, and both modified and unmodified flakes. Site has been destroyed by construction of Hwy. 80.
National Register Potential: No

Site Number: 26Ly62 (previously recorded)
USGS Quad: Two Tips 15'
Map Reference Number: IIIh
Project Area: Fernley-Swingle Bench
Description: Lithic scatter on alluvial slope overlooking Hazen Valley. Site has been collected.
National Register Potential: No

Significance Evaluation

Many of the prehistoric sites listed above are deemed to have potential for inclusion in the National Register of Historic Places. Along the Truckee River pipeline corridor and in the Dodge Flat Site, they are: 26Wa2, 26Wa1601, 26Wa2131, 26Wa2678, and 26Wa2681. The three petroglyph sites (26Wa2, 26Wa1601, 26Wa2131), are significant since they contain unique evidence of the preliterate symbolizing of prehistoric peoples. 26Wa2681 is a seasonal campsite located on the western terrace of the Truckee River. Two distinct assemblages, based on different stone flaking traditions, are apparently represented, Subsequent investigations of the site may clarify these lithic traditions and contribute to our understanding of the various patterns of Truckee River resources exploitation.

Site 26St2678 is a temporary campsite on the edge of a small dry lake west of the Truckee River. In contains both groundstone and retouched (utilized?) flakes, and indications of at least limited depth. Two Rose Springs Corner-Notched projectile points were collected from the surface of the site (Appendix B). Further investigation of the site in relation to others in the general Truckee River area, such as 26St2681, can further contribute to our understanding of the seasonality and scheduling of resource-getting activities.

Eight sites recorded in the vicinity of the High Basin site may qualify for nomination to the National Register as an archaeological district. They are: 26St26 through 26St30, 26St50, and 26St51. The High Basin valley contains a natural source of knappable chert, which outcrops erratically on several low knolls. All of the sites listed above reflect prehistoric quarrying as well as various kinds of lithic tool manufacturing activities. All stages in the lithic reduction process are represented at these sites; and a total of three Rose Springs series projectile points were collected from sites 26St26, 26St23, and 26St30 (Appendix B). Edge characteristics observed on flake tools (utilization and retouching) at four of the sites, 26St26 through 26St28 and 26St50, indicate that task-related activities were conducted at the sites. Finally, site 26St26, located in dunes deposited in a small saddle, has good potential for subsurface depth and hence, the establishment of chronological controls. It contains groundstone, hearths, and other rock features, indicating some duration of occupation and may have served as a temporary base camp. The great variety of prehistoric site types at the High Basin site represent a valuable source of information about the relationship between various different prehistoric resource exploitation patterns and lithic tool manufacturing activities.

Sites recorded in the Fernley-Swingle Bench area are quite diverse. Though all of these sites (26Ch62, 26Ch163, 26Ch583, 26Ch584, 26Ch585) have been seriously disturbed, they are considered to have potential for nomination to the National Register because of the paucity of sites still available for study in the area. Sites 26Ch62 and 26Ch163 are the well known Louse Cave and Sadmat sites. Though they have been already at least partially collected, these sites have significantly contributed to our understanding of the early occupation of the Lahontan Basin and their settings should be preserved. Site 26Ch584 is a large diffuse quarry/workshop site of undetermined age and should be further investigated since it may be related to the earliest sites in the area. Sites 26Ch584 and 478 are aboriginal campsite areas with high research potential. Site 26Ch478 is of special interest since it represents an extensive base camp buried under six to eight feet of overburden.

Mitigation Recommendations

The present ten percent survey conducted for the Reno-Sparks Effluent Study represents only a preliminary stage in the investigation and determination of cultural resources in the project area. Prior to any subsequent impacting project construction, a 100 percent survey will need to be conducted to precisely determine the number and kind of sites present in the area. The number of sites already recorded in the project area is lower than would be expected in a region of known aboriginal occupation. Though agricultural residential, and industrial development has already destroyed many sites, many still extant sites may be revealed by intensive survey. Evidence of buried sites, such as 26Ch478, may also be revealed by a careful examination of road cuts, erosion channels, and other exposure areas. Previous archaeological investigations in the Lahontan Basin and Reno areas reveal a long and complex pattern of prehistoric occupation of the area; however, many important questions remain unresolved. Existing archaeological sites, therefore, must be preserved. All sites (both historic and prehistoric) located within and adjacent to the project area must be protected from adverse impact due to construction, vehicular traffic, unsystematic collection, or other project related activities until these sites can be properly evaluated by qualified archaeologists and historians.

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APPENDIX A

Maps IIIa through IIj:

Locations of sampling units and sites are available to
agencies requiring the information in order
to complete their reviews

APPENDIX B

Illustrations of collected projectile points

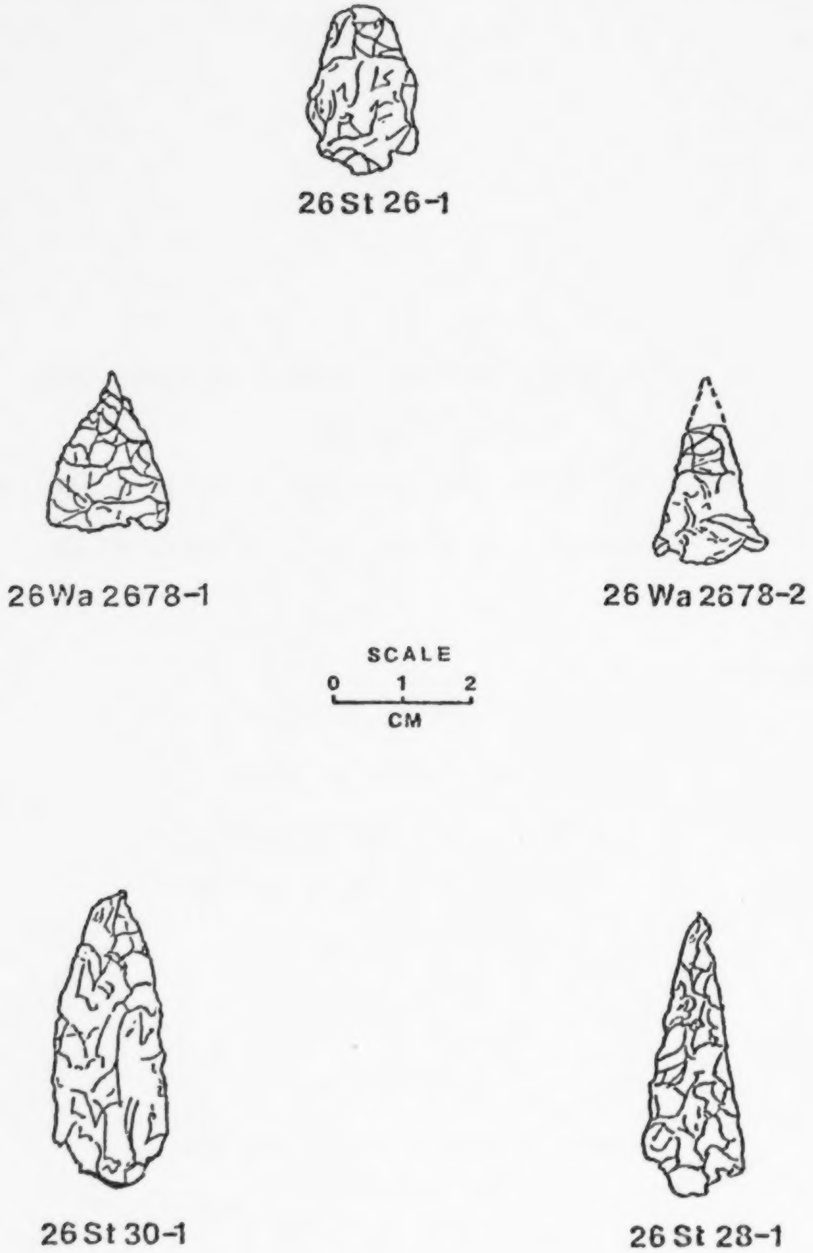
26 St 26-1
26 Wa 2678-1
26 Wa 2678-2
SCALE
0 1 2
CM
26 St 30-1
26 St 28-1

Figure 1: Collected Projectile Points

PRELIMINARY CULTURAL RESOURCES RECONNAISSANCE
# of the
RENO-SPARKS SEWAGE EFFLUENT SLUDGE DISPOSAL ALTERNATIVE
SPANISH SPRINGS VALLEY, WASHOE COUNTY, NEVADA

by

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Desert Research Institute

University of Nevada System

Reno, Nevada

Prepared for

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Sacramento, CA. 95816

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Introduction

Under contract agreement with Jones and Stokes Associated, Inc., Sacramento, California, the Social Sciences Center, Desert Research Institute, initiated a preliminary cultural resources investigation of the alternative sludge disposal area proposed for the Reno-Sparks Sewage Effluent. This proposed alternative consists of approximately 240 acres of land located at the mouth of Spanish Springs Canyon and includes the W1/2 of the SW1/4 of section 8, protions of the W1/2 of the W1/2 of section 17, and portions of the N1/2 of the N1/2 of section 18, T. 20N., R. 21#., U.S.G.S. Vista 7.5 minute quadrangle, Nevada (Figure 1). The objective of this study was to examine the likelyhood that cultural resources occurred in the project area, to evaluate those resources found, and to recommend procedures for their management should the area be selected for future development.

Natural and Cultural Setting

The proposed sludge disposal area lies in a southeastern extention of Spanish Springs Valley near the mouth of Spanish Springs Canyon at an elevation of 4420 ft (1347 m). The sandy alluvial valley floor in this area supports a nearly pure sagebrush (*Artemisia Tridentata*) community with rabbitbrush (*Chrysothamnus* sp.) becoming an important and often dominate associate on eolian deposits and in disturbed areas. Steep (16^{0} to 30^{0}) colluvial slopes of the Pah Pah Range occur immediately east of the project area. Today, these slopes support a sagebrush-grass (*Bromus tectorum*) association.

Little systematic research has been conducted in Spanish Springs Valley concerning cultural resources. A Bureau of Land Management cultural resources survey (Pinzl 1976) along the Bailey-Spanish Springs 14.4KV extension right-of-way (N-12773) through the proposed sludge disposal area revealed only a single isolated artifact (site number 26Wa2412). However, a previous reconnaissance along the proposed Reno-Sparks Joint Water Pollution Control Plant and Pipeline, which parallels the Spanish Springs Road, disclosed a substantial amount (67 sites) of archaeological material (Elston 1976). Similarly, the "Am-Arcs of Nevada" have recorded and tested several sites in and to the east of Spanish Springs Valley (Rusco 1969; Stephenson 1968). Finally, Spanish Springs Valley lies within an area ethnographically used by both the Washo and *Tasiget* Northern Paiute (Stewart 1966:191-203, Maps 15, 21-28). Hence, it was suspected that the proposed sludge disposal area might reveal more cultural resource remains than previously had been indicated by the Bureau of Land Management survey.

Research Methods and Procedures

It was decided that an archival search and a preliminary on-foot reconnaissance of approximately 10 percent of the project area would reveal its potential to yield cultural resources. This methodology was also consistent with other preliminary cultural resource studies conducted for the Reno-Sparks Sewage Effluent Project (Budy 1979). Archival research was conducted by contacting both the Bureau of Land Management, Carson City District Office, and the Nevada State Museum, Carson City, for records of previously recorded archaeological sites in or adjacent to the study area.

Figure 1. Map showing the location of the cultural resources disclosed during a preliminary surface reconnaissance of the proposed sludge disposal area, Spanish Springs Canyon, Washoe County, Nevada. Figure 1 is available to agencies requiring the information in order to complete their reviews.

The preliminary on-foot reconnaissance of the project area was conducted on January 2, 1980, by the author. This reconnaissance consisted of a zig-zag transect traversed within a 200 m wide corridor around the parimeter of the study areas in sections 8 and 17, and a single zig-zag transect traversed diagonally across the study area in section 18. In addition certain topographic features (ridge tops, alluvial fans, and small dunes) in and adjacent to the study area were examined for cultural resources. The relatively open sagebrush cover and recent rainfall afforded ideal conditions for the observation of cultural remains on the ground surface. Cultural resources located during this survey were recorded on standardized site inventory forms (Appendix A).

Research Results

Field reconnaissance of the proposed sludge disposal area revealed six previously unrecorded cultural resources and disclosed additional cultural remains at the location (26Wa2412) of a previously recorded isolated flake. Characteristics of each cultural resource known to occur in the study area are outlined in Table 1; site forms are included as Appendix A. These cultural resources, although representing only a portion of the total cultural resources in the study area, probably accurately reflect the kinds of archaeological materials which may be expected to occur there.

Three located archaeological sites, 26Wa2690, 26Wa2693 and 26Wa2694, are characterized by small (1 to 2 ares), dense concentrations of lithic debitage from similar raw materials. These sites probably reflect localities where aboriginal Indians shaped and resharpened stone tools. They occur on a variety of landforms supporting nearly pure sagebrush stands. The fact that flakes from only a single raw material type occur at these sites is interpreted

Table 1. Selected characteristics of the cultural resources located during a preliminary surface reconnaissance of the Reno-Sparks sewage effluent sludge disposal area, Spanish Springs Canyon, Washoe County, Nevada.

Site Number	Area (ares)*	Landform	Vegetation[†]	Description
26Wa2412	4.5	Alluvial Ridge	Sagebrush/Rabbitbrush	Sparse scatter of white chert, yellow jasper, basalt, and tachylyte flakes
26Wa2689	450.0	Eolian Dunes	Rabbitbrush/Sagebrush	Diffuse scatter of white, red and white, gray, and green chert, basalt, and tachylyte flakes;two basalt milling stones; and two rock features
26Wa2690	2.0	Colluvial Slope	Sagebrush	Dense (20 flakes/m^2) scatter of white chert thinning and reduction flakes
26Wa2691	160.0	Colluvial Ridge	Sagebrush/Rabbitbrush	Sparse scatter of white, red and white, and gray chert, red and yellow jasper, and basalt flakes, One basalt mano,
26Wa2692	10.0	Eolian Dunes	Rabbitbrush/Sagebrush	Sparse scatter of white chert, yellow jasper, basalt and tachylyte flakes and basalt bifacial chopper
26Wa2693	1.0	Alluvial Flat	Sagebrush	Dense (15 flakes/m^2) scatter of white chert thinning and reduction flakes
26Wa2694	1.0	Alluvial Ridge	Sagebrush	Sparse scatter (4 flakes/m^2) of white and red and white chert thinning flakes

* An are is definded as 100 m^2

† Vegetation is listed in order of dominance

to indicate that these loci may have been used for a single chipping activity (stone tool manufacture) of relatively short duration. No tools nor diagnostic artifacts were associated with these chipping stations.

Two archaeological sites, 26Wa2412 and 26Wa2692, are typlified by relatively small (4.5 to 10 ares), sparce scatters of flakes and flake tools made from different raw materials (chert, jasper, basalt, and tachylite). Functional interpretations of these sites are not possible with the present data base; however, I suspect they might reflect relatively short term activities other than stone tool manufacture. However, both sites occur in geological contexts which may contain subsurface deposits bearing cultural remains and those remains observed on the surface may reflect only a portion of the actual assemblages at the sites. Laboratory analysis of cultural materials from these sites could aid in evaluating their functional meaning.

The final two archaeological sites, 26Wa2689 and 26Wa2691, discovered during this preliminary reconnaissance cover relatively large (160 to 250 ares) areas and consist of a variety of artifacts and raw materials. Both sites contain ground stone tools. In addition, Site 26Wa2689 is also characterized by two unnatural concentrations of small (10 to 15 cm maximum dimension), rounded basalt cobbles arranged in rounded, but irregular, patterns 2.5 to 3 m in diameter. These features could reflect several activities and further research is necessary to assurn their specific meaning. The presence of these features, grinding slab framents, as well as widely scattered flakes of different raw material types, are interpreted to imply that site 26Wa2689 may represent a more permanent loci of aboriginal Indian activity. This site occurs in a geological context which is extremely favorable for buried cultural remains. Site 26Wa2691, although characterized by an artifact assemblage similar to 26Wa2689, occurs on a colluvial ridge and lacks the stone features of 26Wa2689, Hence, these two sites reflect different cultural events. Further research would be necessary to assurn the cultural/functional relationships between these sites. Both have the potential to yield subsurface cultural remains.

Unfortunately no diagnostic artifacts were recovered during the preliminary reconnaissance of the proposed sludge disposal area. Thus, it is difficult to estimate the probable time depth or cultural affiliations represented by these cultural resources. This absence of diagnostic artifacts might be a reflection of: (1) sampling error, (2) the nature of aboriginal use of the study area, or (3) intensive surface collections by vandals. Since the study site occurs in an easily assessable area adjacent to a major modern population center, I prefer the latter interpretation.

Conclusions and Recommendations

The primary objective of the Desert Research Institute's investigations at the Reno-Sparks Sewage Effluent proposed sludge disposal area was to assess the likelyhood that significant cultural resources occured within this area. Our research clearly shows that the area was used by aboriginal populations. However, it is not possible to assess the exact nature or time of this use with the present data base. Hence, it is strongly recommended that a 100 percent cultural resources reconnaissance be made of the area if it is selected for future development. This additional data base would not only result in a complete inventory of cultural resources in the area, but would allow a better evaluation of these cultural resources than now possible. It is at this time that each cultural resource should be evaluated for its eligibility for listing in the National Register of Historic Places.

Although preliminary in nature, it is possible at present to indicate the suspected significance of the cultural resources located during the Desert Research Institute's investigations and to recommend several procedures which should be followed concerning the known culutral resources in the proposed sludge disposal area.

All sites occur on substrata which have a potential to yield buried cultural remains. However, certain sites (the chipping stations 26Wa2690, 26Wa2693 and 26Wa2694) have surface assemblages which might indicate relatively short term aboriginal activities; whereas, the other sites have indications of either longer occupations, more diverse activities, or repeated short term utilizations. Of this latter category, Site 26Wa2689 has the best potential to yield significant subsurface cultural remains and certainly should be test excavated for this capability. On the other hand, the chipping stations (26Wa 2690, 26Wa2693 and 26Wa2694) have the least potential to yield significant subsurface cultural bearing deposits. Nevertheless, this potential or lack of potential should be firmly established by further research.

Hence, it is recommended that a 100 percent cultural resources survey be conducted to obtain a complete inventory of sites in the area. Then, on the basis of surface indications, these sites could be categoried according to site type and suspected potential to yield subsurface cultural remains. Each category of site then could be sampled by test excavations to establish the actual existence of buried cultural remains. Those site types yielding buried cultural remains would require further excavation. Those site types not yielding subsurface remains could be mitigated against any adverse impact by insensive surface collections. Finally, because it would not be economically nor scientifically pratical to mitigate each and every archaeological site in the study area, it is recommenced that only a sample of all sites be collected and/or excavated.

The determination of the exact sample size and content should not be made until after the 100 percent cultural resources survey. Since most of the study area lies on Bureau of Land Management lands, all activities concerning cultural resources should be closely coordinated with the Bureau of Land Management's Carson City District Archaeologist.

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APPENDIX A

Site inventory forms are available to agencies requiring the information in order to complete their reviews